SUPPLEMENT.

The Mining Journal,

RAILWAY AND COMMERCIAL GAZETTE:

FORMING A COMPLETE RECORD OF THE PROCEEDINGS OF ALL PUBLIC COMPANIES.

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Original Correspondence.

MINING IN NORTHAMPTONSHIRE.

There is now more than usual activity at the various ironstone districts in Northamptonshire, and it is evident, from the large quantities being sent to nearly all parts of the kingdom, that the actual value of the ore is gradually being appreciated by practical ironmakers. At the same time, there is evidence of a large increase in the out-put, with every prospect of new districts being opened out which the mineral is known to exist. For many years the producers of ironstone in the county laboured under the great disadvantage of their ore being underrated in other districts by those who had some interest in doing so; but now, by the most convincing of practical tests, its value has been recognised, and it is admitted to be much superior to the Cleveland, Lincolnshire, and the argillaceous ores of Shropshire and South Staffordshire. Mr. W. Butlin, of Wellingborough, who was the first to produce iron from the Northamptonshire stone, as will be seen from metallurgical statistics, has produced as much as 52 per cent. of metal from the ore near to his furnaces, whilst from 30 to 42 per cent. is the ordinary yield. Such being the case, we were not surprised to hear that some of the ironmakers in Cleveland, aware of the value of stone so rich in metal, containing a good deal of silex, and comparatively free from phosphorus, should be now making enquiries as to the terms on which it could be sent to the North of England, Although this might appear something like "sending coals to Newcastle," yet when it is taken into consideration that by a judicious admixture of different qualities of ore a superior quality of iron can be made, it will be apparent that the Cleveland ironmasters would find it to their advantage to use a foreign with the local stone. This is generally acknowledged, for it is admitted that much of the success attained in Middlesborough has been owing to the attention paid to, and the application of, analytical chemistry in determining the nature and character of the ores they have to use, and accordingly proportioning the fuel and flux required in producing iron.

The actual extent of the ironstone field of Northamptonshire has not as yet been defined, but that it extends throughout the greater part of the county admits of little doubt. It has been found at the northern extremity of the county, at Peterborough, on the estate of the Marquis of Huntley, and it is worked higher up, near to Thrapstone. On the Midland line it is met with on the borders of Leicestershire, and has been cut through at Market Harborough, Kettering, Rushton, and in a straight line into the town of Northampton. It passes through a portion of the estate of Lord Overstone, where there is not only plenty of good stone, but lime also; but his lordship does not apparently care about opening out the minerals on his property. About two miles from Northampton, on the estate of Earl Spencer, a good deal of stone is raised, and also at Heyford, and towards Weedon, and close by the side of the London and North-Western Railway at Blisworth and Gayton. In the neighbourhood of Daventry, which might be made an important centre of the iron trade, there is also plenty of ironstone in the hills around it, and, as the town has made little or no progress of late years, the wonder is that the leading inhabitants have not taken advantage of the natural facilities of the locality. Only four miles from the main system and station of the London and North-Western Railway, it has not a line running into the town, although nearly two miles of a branch have been made. It, however, boasts of a large and very fine hotel, the chief, and we are glad to find that an effort is being made to complete the branch line to which we have alluded. From Daventry to Oxendby there are large and valuable tracts of highly mineralised ground, but which, for the want of the necessary railway facilities, remain not as yet be developed. During the last few weeks, however, it is said that some gentlemen have been visiting some of the districts referred, with a view to opening out the ore. Looking at the vast extent of mineralised ground at which we have glanced, extending from the extreme of the county to the other, it will be apparent that Northamptonshire requires but little to make it a by no means despicable rival to the great Middlesborough district, and to which it is superior in the quality of its stone. That the progress made, at first slowly by no means good, has been remarkably rapid during the last 10 years may be judged from the fact that whilst in 1860 the quantity of ore raised was only 95,644 tons, in 1868 it had increased to 329,116 tons, an increase of about 470 per cent. in eight years, and which has not been equalled by any mining county in the kingdom. The increase has also been fully maintained last year, and even more than maintained, so far as the present year has advanced.

With regard to the work being done at the leading establishments, there appears to be not only a very much larger quantity of iron being made, but a marked increase in the tonnage of ironstone sent to other districts. At Wellingborough there are three furnaces in blast, and a fourth was expected to be blown in towards the end of the present week. In addition to the ore required for the four furnaces, the Messrs. Butlin, who are now the largest producers of iron and ironstone in the county, are sending from 2000 to 3000 tons per week over the Midland to Derbyshire and Yorkshire. The firm has also just completed a siding from the works on to the London and North-Western Railway, so that they will be in position to send into Staffordshire and South Wales, and no doubt largely increase their present production. The Glendon Company, at Finedon, have three blast-furnaces going, and are sending a good deal of stone into Derbyshire. From Twywell, also, a good deal is being sent into different localities from General Arbuthnot's pits. A new field has been opened out at a place called Cogenough, by Mr. Whaley, owner, who is also raising sand and limestone, and clay for bricks. At Gayton and Blisworth a considerable tonnage of stone is being sent and forwarded to Staffordshire and South Wales, where there are markets for nearly all that is raised. The furnaces at Lower Heyford are doing more than for some time, the works now being in the hands of Mr. Plevins. There is plenty of ironstone at hand, so that there is now a good prospect of the works being kept fully going. Elsewhere all is quiet.

Before closing our remarks concerning the iron and ironstone of Northamptonshire, we may say that from practical tests it has been found that a combination of the Lincolnshire and Northampton ores will produce a really excellent quality of iron, and it is considered a mistake on the part of the lessor of the stone in the former case to exclude or prevent the admixture. The mixing of a stone, like that found at Frodingham, containing as it does a very large quantity of limestone, with a fine silicious ore, such as the Wellingborough, would be highly advantageous in the production of a finer quality of iron than it is possible to obtain from stone containing so much lime.

The question as to whether coal was to be found in Northamptonshire at a workable depth, and which caused so much sensation when first mooted in the Journal last year, has again cropped up, and there is now a more hopeful prospect that the question will be settled. Several geologists have declared that no coal, even of a minimum thickness, would be reached at anything like a moderate depth. On the other hand, several mining engineers and other practical men, after having examined the strata got out of the pit at a place called Kingsthorpe, many years ago, when a shaft nearly 300 yards deep was sunk, without hesitation have agreed that the coal was to be found, and at not much greater depth than had been gone. Some of them have not only offered to give their personal assistance in bringing the matter to an issue, but have even offered to subscribe towards the necessary expense. At the time the shaft was being sunk the geologists stated that the blue lias was 700 ft. thick, but it was got through in 100 yards; and Dr. Buckland was the first to admit that the geologists were incorrect in their views. As not only all the ironmakers in the county, but the lessors of ironstone also, and amongst them Earl Cowper, whose attention, we understand, has been directed to the matter, have a direct interest in the subject, it is to be hoped that a question of such vast importance to all classes in Northamptonshire will at last be solved. Should coal be found, then, Northamptonshire would be not even second to Cleveland, but would become one of the first centres of the iron trade in the kingdom. It would bring thousands of working men into different parts of the county, raising places at present mere villages to the rank of towns, besides being the means of distributing a vast amount of capital over several districts, and in which all classes would be partakers. If not found, then the *statu quo* would be maintained notwithstanding. The subject is one of deep importance, and its solution is now looked forward to with absorbing interest.

MINING NOTES FROM DERBYSHIRE.

There are few counties in England where such a variety of strata, and of so valuable a description, is to be found as in Derbyshire, for independent of the lead, iron, and coal mines which are to be met with from nearly one end to the other, there are zinc, manganese, and copper deposits also, with vast limestone beds, in which black and grey marble are found, chert or china-stone, the fluor-spar known as "blue John," gypsum, &c. The outcrop of the carboniferous limestone forms the lead district of the county, no inconsiderable portion of the mineral riches of which are due to the lead mines, which are probably about the oldest to be met with in England, having been worked anterior to the Roman invasion. For a number of years past the output has been very uncertain, and but little progress has been made, few capitalists having appeared desirous of speculating in districts so old, and which had been worked so long. Another great drawback, no doubt, has been the easy means by which men without capital have been able to take tracts of land, and keep them just so long as they could earn sufficient to live upon, but unable to go down to any great depth. Of this there was a notable example at Bakewell only a few days since, when Mr. Farnsworth, of Matlock, bought the mines known as Great and Little Greensward, and the Deep Moor Pipe, with their connections, tools, and the lead ore about them, for the sum of 10*l*. On the other hand, where efficient machinery has been put down to raise the ore and keep the mine free from water, the results have generally been satisfactory, for as a rule the returns in a great measure depend on the outlay, and that is the best economy which leads to the ore being raised in the shortest time, and minimising manual labour as far as possible. That the quality of lead obtained during the last few years has varied very much will be seen from the following returns:—

	Lead ore.		Lead.		Silver.
1866	Tons 6431	12	Tons 4921	6	Ozs. 984
1867	4916	15	3873	0	1000
1868	5933	0	4395	18	1150

For 1869 it is expected that the return will show a considerable increase over the previous year, seeing that several mines in which powerful machinery have been put down for drawing out the water were enabled to raise a good deal of ore.

Wirksworth, from time immemorial, has been the centre and capital of the lead mining districts, and at present in its Barmoot Hall is the "dish," or standard measure, presented by Henry VIII. The town, however, is not by any means so prosperous as it has been, for but few mines in its vicinity are now being worked, although of the 70 in the county nearly one-fourth are within its boundaries. Standing within half a mile of the town some eight or ten places are discernible which were once mines, and where a good deal of ore at one time was raised, but which have now been abandoned. Still, there are a few good concerns being worked, foremost amongst which is the Bage Mine, within half a mile of Wirksworth; it is worked by engine-power, and they are now sinking for water. More than 100 men are employed at the mine, from which a large quantity of ore is being raised. Mr. Wass is the principal owner, as he is also of several other mines, including the Mill Close Mine, at Wensley, which is now doing very well, there being the most complete machinery and appliances for doing an extensive business. Mr. Wass has recently taken to some mines belonging to Mr. Arkwright, and is now the largest owner, not only in the district, but probably in the county. At the present time he has a number of men engaged in "prospecting" in different places. That we have not over-rated his position will be seen from a statement he made a few days since at the annual miners' dinner—a festival which, by the way, has been held in May for some hundreds of years, it is said—in replying to the toast of "The Lord of the Field, F. Arkwright, Esq." In the course of his remarks he said "He was the only person who had been left to speculate in mines. He believed that brighter days for the miners of the district were coming—as bright as the sun then shining compared with the dismal morning they had experienced." As Mr. Wass is not only a large mine owner, but also a lead smelter, it may be readily assumed that the prospects of lead mining in Derbyshire are more encouraging than they have been. At Shore Vein and Moor Grove a little ore is being raised, and the men are engaged in driving out, in the expectation of meeting with ore. At Meerbrook, also, they are driving out with the same object. Some of the mines at Great Hucklow and Peak Forest are doing tolerably well, as are several of those at Eyam, where the mines are carried on by limited companies, and where the putting down of machinery for getting rid of the water has led to good results. One of the great disadvantages of Eyam and the district is that it has no railway communication whatever within several miles of it, although it has many elements about it which could be turned to advantage were there the necessary transit facilities.

If no great progress has been made in lead mining in Derbyshire for some years, yet there is no county where there has been such a large increase in the quantity of coal raised, or where the prospects as to the future are of a more healthy character. From Clay Cross alone, where prior to the opening of the Midland line not a ton passed over the ridge, now nearly 400,000 tons are forwarded yearly to London. At Staveley also, where are the largest foundries in the kingdom, and where nearly 5000 persons are employed, the collieries are capable of yielding 800,000 tons per annum, whilst the coal field at present will comprise something like 7000 acres, producing a fine quality of what is known as the Black Shale coal. On the Erewash Valley Railway are some of the largest collieries in the county, including Codnor Park, and some 10 or 11 others belonging to the Butterly Coal and Iron Company, who are amongst the largest producers of iron in the kingdom, having a large number of rolling-mills going, as well as puddling-furnaces. In the southern part of the county, near to Burton-on-Trent, there is also a large coal field, and where the coal itself is from 12 to 16 ft. thick. At the Church Gresley Colliery it is got 10 ft. thick, the remainder standing as roof. Near to the above colliery is the great "fault" of the county, and which has been found to extend ¾ mile in one direction. Between Sheffield and Chesterfield several new collieries are being opened out, and, as the Midland line affords good facilities and moderate rates to the South of England, that district will shortly send a very large tonnage on to the main system.

In nearly all the coal mining districts in Derbyshire a good deal of ironstone is being raised, nearly the whole of which, as well as a good deal of imported ore, is smelted in the local furnaces, the production of last year being about 380,000 tons. It is, however, expected that by the opening of the minerals in the Unstone Valley the production during the present year will be very largely increased. There are now about 34 furnaces in blast, whilst in 1868 there were only 28, so that the pig-iron being turned out this year will be very much larger than it ever has been.

From the above facts it will be seen that mining of every description in Derbyshire is looking healthy, and although there are some districts which are by no means active, yet there is every appearance that the development of the valuable minerals which abound in nearly all parts of the county will be marked by the same progress which has been made during the last year or two.

DEEP MINING IN THE SOUTH WEST OF IRELAND.

In last week's Journal reference was made to a paper by Captain S. Hyde, F.R.G.S., read before the Geological Society, and reprinted in pamphlet form, with additional reports, maps, and plans, "On Deep Mining in the South-West of Ireland." The area treated of extends from Dungarvan and Youghal Harbour on the east to Cork Dunmanway, and so on to Dursey Island, west of Bantry Bay, and is so important from an economical point of view as to deserve the attention of all interested in the prosperity of that country. Certainly anyone who succeeds in showing a new development of industrial resources, and opening up a new fertilising source of wealth in Munster will deserve gratitude as a true pacificator of Ireland. To those who have at all examined the mineralogical capabilities of the country it is well known that Prof. Jukes put forth authoritative statements as to the Irish copper zone, which occurs near the lower boundary of the upper and lower Old Red Sandstone. He supported the theory that from the mechanical deposition of copper all the grits and slates over the copper zone were impregnated with copper ore, occurring in irregular particles in different beds, through a thickness of 300 or 400 ft., which have undergone subsequent disturbance and fracture, resulting in the segregation of copper into the fissures, forming new mineral veins. His verdict was that the wide diffusion of copper ore in small quantities over so large an area is against rather than in favour of the probability of rich mines being found, and stated that up to 1861 "none of the lodes, whether true or false, of the south-west part of the county Cork have yet been proved to have a sufficient quantity of ore in any one locality to realise a rich mine." So strong and judicial an opinion necessarily checked enterprise. The ore was found to be in "bunches" in the shallow workings, and the mine owners were content to pick it out without venturing deeper, save at the Allihies or Berehaven Mines, which carried to 1300 ft. below the roots of Slieve Miskish, have yielded, it is said, 2,000,000*l*. worth of copper. The opinion of Prof. Jukes has been from time to time controverted by eminent geologists, notably by Prof. Forbes, at the British Association meeting of 1865. It has now been practically refuted; Berehaven Mines are no longer the only exception, the rule is rescinded, and they are the first example in point of time, though not, we expect, of merit; and we claim for Ballycummisk the honour of the second place, as showing that in Cork, as in Cornwall, deep mining, and it alone, will really and substantially pay and develope the resources of the country. We wish that we could go more at length into the interesting question of the correlation of the Irish and Cornish Devonian systems, so ably treated in this paper. The subject has presented difficulties not yet cleared up, one being the almost entire absence from the Irish system of igneous rocks, such as occur protruded through, or underlying and affecting, the killas and grits of Cornwall; the unfossiliferous nature, too, of the Kerry beds denies us palæontological evidence. Again, the Irish Old Red Sandstone reposes on the Upper Silurian of Dingle, and the Lower Silurian in Waterford; while the English Devonian series have no known base. Still the relation of the lithological conditions of the North Devon Devonian rocks with those of the South-West of Ireland is almost complete; the stratified rock masses of the south-western peninsulas are of one age, and partake of the same general structure—the lithological conditions, mineral evidence, and the actual results of mining experience, which latter may be now expected to accumulate every day, tend to confirm the opinion which regards the South of Ireland as once a continuous and integral portion of the South-West of England and South Wales. The details of the common Devonian system in the two countries involve, indeed, questions of terms, but not difference of age, applying to the Irish area the received canon that all rocks formed after the uppermost of those which can be properly called Silurian, and before the lowest of any properly called Carboniferous, may be regarded as rocks of Devonian age. But we proceed to a description of the mines whence the data for these, shall we say speculations or inductions, have been drawn. The locality is thus described. The so-called Carboniferous slate between Cork Harbour and Dunmanus Bay divides at Carrigalicky Lake into a north and south range; the northern spur stretches into and occupies the north and south sides of Dunmanus Bay, its southern branch terminating at Inishbeg, near Skibbereen, forming the east headland of Roaring Water Bay. The ridge which rises at Mount Gabriel to 1339 feet is cut by broad transverse valleys. The most important one at Ballydehob gives rise to the waters flowing to Roaring Water Bay. From Ballycummisk and Schull Harbour to Toormore Bay, and on to the Mizen Head, a smaller ridge of land runs parallel to the main axis, and it is in the east part of this range that the mines of Ballycummisk and Coosheen are situated.

A series of anticlinal and synclinal curves occur in this region, the chief of which is that which traverses Ballydehob, Schull, Toormore Bay, and Crookhaven, &c. The axis of the Ballydehob anticlinal strikes east 25° north, with a general dip to the north-west of about 50°, and to the south-east 45°, and it is along this that the highest land occurs, being mainly composed of slates and gritty beds of the upper part of the lower Old Red Sandstone. South of this, between Cappagh Lodge and Schull Harbour, and close to Rossbrin Cove, are situated the extensive and deep copper mines of Ballycummisk. Owing to the position of the main road, and the close vicinity of the sea, a safe berth being thus afforded, the situation surpasses that of the Berehaven Mines; the exposed roadstead of Ballydonegan Bay not bearing comparison with the sheltered anchorage or wharfage of Rossbrin.

Eight lodes have been ascertained to occur, and have been proved by the deep adit level driven from the sea at Rossbrin Cove, the whole hade, dip, or underlay south 85°, or about 1 in 12. Each lode is characterised by particular features, the copper being grey, purple, or yellow in one, yellow in another; micaceous iron, quartz, baryta, and yellow copper in a third; and carbonate of lime, peach, purple, copper ore, &c., in the fourth. The remaining lodes in the sett are as yet unexplored. All the lodes are parallel, and run east and west, deviating about 32° north of east and south of west.

A well-defined elvan course traverses the sett nearly east and west, and nearly parallel to the No. 1 lode. To the north, and bearing north-east and south-west, occurs the large fault or flookan course, which deviates about 17° from the strike or bearing of the lodes, and crosses all the veins except No. 1. This flookan, like the lodes, underlays south, and materially influences the production of mineral at its junction with the lodes. The depth reached is 1200 feet; the 198 fm. level, or Big Ben, being extremely rich in yellow and peacock copper ore, magnificent specimens of which are now in London, and no diminution in either produce or yield seems likely. There is a strong tendency to culmination in the vein. The mineral from this mine has been declared to be undistinguishable from the richest Berehaven ores. As from the old shallow mines 50,000*l*. was returned, the skill and enterprise manifested in the new deep working may be expected to reap a rich harvest.

We would here remark that the term elvans in Ireland is not strictly equivalent to the Cornish. Certain light-green coarse sandstone bands occurring with the killas are termed elvans in Ireland, whereas the elvans in Cornwall are of igneous origin, and as true dykes traverse the killas almost without law. Nevertheless, the same relation of the elvan courses to the copper lodes is found in Cornwall as in Ireland. They run nearly parallel, or with only a small angle of deviation; of this the elvan in Ballycummisk is a notable example. The nature, however, and true relations of the Irish elvans to their own and

the Cornish rocks and minerals are at present little understood. On these, as on many other cognate questions, works like those at Ballycummisk may be expected to throw much light.

West of Ballycummisk, and immediately east of Schull Harbour, is situated Coosheen Mine, where there appear to be no less than eleven lodes, which some years since were proved and worked upon. All these are east and west lodes, varying in their bearing of direction from 10° east to 25° north. Seven of the eleven are copper-bearing, containing either yellow, purple, and grey ore, or green carbonate, and underlay or dip south. The sett is traversed from north to south by a cross-course or fault, accompanied by a parallel and well-determined flookan, which seems to have shifted the lodes. The killas to the south of the Coosheen dips north 40° to 60°, implying that the mine is situated in a synclinal axis, parallel to the Ballydehob anticlinal, and may be the north dip to the north-west face of the anticlinal, which runs south of Ballycummisk Mine and through Rossbrin Cove. No less than five faults traverse the copper-bearing zone of the Upper Old Red Sandstone, between Cappagh Mine on the east, and Schull Harbour on the west, and the lodes of Ballycummisk and Coosheen are all more or less affected by them.

It may be important to state that, at 42 fathoms from the surface, and 16 fms. below the deep adit, the No. 6 or old lode dipped south 6° in 1 (or 80°), and contained a leader of 7 in. of solid grey copper—the remaining 6 feet of the lode being composed of "quartz, grey copper, green carbonate, and blue peach." Even at the limited depth or shallow working mentioned upwards of 20,000*l.* worth of copper ore has been returned. It is believed, from the nature of the lodes, that Coosheen will be carried down to depths equal to that of Ballycummisk, for it cannot be doubted but the lodes of both setts are the same, and all are more or less parallel to the strike of the Upper Old Red beds; and such appears to be the law as regards the position and run of the lodes in the South-West of Ireland.

This is further shown by a recent report made by an able and experienced investigator, who states as follows:—"The investigations made by me in this mine enable me to state positively that the mineral deposits of Coosheen Mine are true mineral lodes, in the full acceptation of the term. I am informed that over 20,000*l.* worth of copper ore was returned in the prosecution of these shallow workings. It will be seen on reference to plan C that both elvan and flookan have performed their part in intensifying the mineralisation of the whole of these deposits, and causing the development of the large shallow deposits which have been discovered, and to the attainment of which, at any sacrifice of future success and facility of working, the efforts of previous explorers appear to have been directed; and I am of opinion that, in the headlong rush after immediate returns, the true and solid products possessed by the mine (as a mine) have been both passed by and left undisturbed below."

The latter words are true, we fancy, of many an Irish mine, but such results as these show that there is a good time coming, when, to quote the words of the author of the paper, "it is evident that, with a thoroughly organised system of mining, based upon known local laws and conditions, and with capital properly employed, the South-West of Ireland will take a prominent place in the history and practice of mining."

THE SOUTH STAFFORDSHIRE COAL FIELD.

THE SANDWELL PARK MINING SCHEME.

SIR,—Whenever any new scheme of any kind is set afloat, it is astonishing to witness the great multitude of spectators, some professing large faith and hope, wishing the scheme all the success it deserves. Others, who are hard of belief, and are ever desponding, and looking at the "dark cloud" rather than the "silver lining," behold the passing event as something presumptuous and ridiculous. Some look on it from the "dog in the manger" point of view; others from an equally selfish one. During the past few weeks no scheme has been subject to criticism more than the Sandwell Park Mining Scheme. While not a few of our *acknowledged savants*, professing faith and hope, based upon scientific deduction, give or take a favourable view of the scheme, a lot of lesser lights come forward, without the slightest modesty, and announce to the world at large their opinions concerning the undertaking and its supporters. One, of the name of Mr. Laxton, writes to local papers in a style certainly unique. He challenges a certain person (and I suppose the public too) to find any indication "of the Thick coal, or any other," existing at Sandwell, on the Geological Map; or if he (and I suppose they) "can find me where Sir Roderick Murchison's or the late Beete Jukes's theory upon this matter says the Thick coal does exist there, and at what depth; but that he will find their views are a matter of probability and doubt respecting it." With regard to the Geological Map showing the presence of Thick or other coals under Sandwell, I can only say that Mr. Laxton does not at all appear to know anything about the construction, colouring, and general arrangement of the invaluable Ordnance Maps. The Geological Map gives every reason for supposing that our South Staffordshire coal field does extend underneath the Permian Sandstone of Sandwell estate. Sir R. Murchison gives his opinion not only in his works, but in a letter written by himself to a friend of mine within the last three months, which *brochure* I have seen and read, that coal will be found under the estate in question. Our much-lamented friend Beete Jukes held the same opinion.

As to the following ingeniously puzzling piece of composition, there is nothing in it to warrant the deduction of Mr. Laxton:—"I have taken my views, and given opinions, from actual facts underground, *which is a clear proof to all geological theory** of the trial heads driven in the direction of this estate, along the western side of the great eastern fault, and the result was no coal." Mr. Laxton forgets (perhaps) to inform the public of the many 100 yards that have been stripped in the same direction, leaving a fine rib of good Thick coal.

I could show Mr. Laxton—and others can too—where in a property of only a few acres heads have been driven with the same results as he mentions, but within a trifling distance the disturbance has been passed through, and all minerals been found as before.

It appears to me very absurd to condemn, *in this particular circumstance*, an estate containing over 1000 acres, because a small head or two, not more than 6 feet wide, have been driven "in the direction of this estate," and proved no coal.

I question if Mr. Laxton can give any authentic details respecting this heading. After this general and sweeping condemnation Mr. Laxton, in the same breath, says—"My theory still is that this fault is the splitting up of the Thick coal into different beds on its eastern side, and that it is probable that they will meet with coal in the sinking, the working of which will remunerate them for the outlay; but not a Ten-yard coal, and at what depth under the Permian formation is a matter of doubt also, to which my paper alludes." This is strange logic, strange reasoning—it is like inflicting a wound, then denying that the wound exists, and afterwards actually applying a remedy to cure the wound.

We would not for a moment defend the scheme from public criticism, but when we find such effusions of unfair and unjust critiques, we only do an act of public justice by dissecting them, and showing their fallacies. The proposed scheme is a noble one, science as far as it can favours it, and every person who can boast of a grain of good sense must admit that the proposed means for carrying it out are the very best that can be adopted. Any way it will give to science a valuable wrinkle, and if successful will re-invigorate the strength of our "Black Country," and bless it with the freshness and vigour of youth, which is "a consummation devoutly to be wished for."—*Willenhall, May 25.* T. PARTON, M.E., F.G.S.

* Italics are mine in this case.

GUN-COTTON, DYNAMITE, AND OTHER EXPLOSIVES.

SIR,—I have read the correspondence relating to Explosives with some interest, and particularly the letter signed "W. O." in the Journal of May 7. I fully expected, after the very serious charges made in it against Prof. Abel, that either he or someone for him would have written you something to remove from him the very grave charge that he, a Government official, being at the same time largely interested (directly or indirectly) in the manufacture of Gun-Cotton, used his influence with the Home Secretary to pass as a Government measure the Nitro-Glycerine Bill of last session, by which means all the more powerful explosives, excepting only Gun-Cotton, are excluded from use. If the statements in that letter are true, it is Col. Boxer over again in an aggravated form, and such a state of things should not be allowed to exist, particularly by a Liberal Government, for one day. No doubt a measure was necessary to prohibit the storing of Nitro-Glycerine in large quantities, as also its transit, but when it has been proved, by Mr. Horsley's patent, that in combination with other substances it can be rendered quite safe, it is a very great hardship upon the owners of patents granted by Government, and for which large sums have been paid, that by this Nitro-Glycerine Bill they are shut out from using their inventions at all.

I have tried Dynamite on several occasions, and can quite confirm all that has been said about it for its safety; but there *is* a feeling *against* it among miners, and based on the fact that in close workings or in ill-ventilated shafts the *fumes* are noxious, which is applicable also to Gun-Cotton. This objection, however, does *not* apply to Mr. Horsley's recently-patented Blasting-Powder, which I have no hesitation in saying is stronger than Dynamite, and equally safe for all practical purposes, and enables and permits the miner to resume work *immediately* after a blast; but that able and scientific gentlemen, after devoting many years of his life to the invention and perfection of Explosives, is for the present at least precluded from making use of his discoveries, because his powder contains a *small* portion of Nitro-Glycerine, mixed with chlorate of potash, &c. The fact is that Prof. Abel is the only chemist employed by the Government that has any *practical* knowledge on the subject; the others, though men of undoubted ability, not having turned their attention to the subject, and not caring to do so, cannot give a satisfactory opinion as to the invention. I hope that Prof. Abel will in some way take notice of the letter of "W. O.;" as certainly, if it is not founded on fact, he should not permit such a statement to remain uncontradicted. C.

THE METALS AND THEIR ORES—No. III.

SIR,—DUCTILITY.—The malleable metals are ductile, and the most perfect of them may be drawn into wires of almost any length or size. Gold exhibits this property to the greatest extent, and a single grain may be drawn into a wire 345 ft. long, Dr. Wollaston even succeeded in obtaining 700 ft. of wire from 1 gr. of gold. Six of the most ductile of the metals are—

Gold,	Platinum,	Nickel,
Silver,	Iron,	Copper.

The brittle metals are not ductile.

TENACITY, or the power of sustaining weight or strain, is another property enjoyed by the malleable and ductile metals, but not, however, in the order of their malleability or ductility. Iron is the most tenacious of all the metals, and a wire 1-36th of an inch diameter will bear a weight of 60 lbs.; lead is the least tenacious of the ductile metals. Guyton Morveau, by a series of carefully-conducted experiments, ascertained, by noticing the greatest weight that different wires of a uniform size would sustain without breaking, that each wire of 0·787 of a line in diameter was capable of supporting weights as follows:—

Iron	549·250 lbs.	Gold	150·753 lbs.
Copper	302·278 ,,	Zinc	109·549 ,,
Platinum	274·320 ,,	Tin	34·630 ,,
Silver	187·137 ,,	Lead	27 621 ,,

HARDNESS is another quality in the relative degrees of which the metals vary considerably. Titanium, manganese, iron, nickel, copper, and palladium are amongst the harder metals. Gold, silver, and lead are softer than these, whilst potassium and sodium are the softest of the metals.

FUSIBILITY.—The metals differ as much in fusibility as in tenacity, density, or hardness. The following table gives the point of fusion of the different metals:—

Mercury	39° Fah.	Cadmium	442° Fah.
Potassium	136° ,,	Bismuth	497° ,,
Sodium	194° ,,	Lead	612° ,,
Lithium	356° ,,	Zinc	773° ,,
Tin	442° ,,		

All the above, including antimony, arsenic, and tellurium, are fusible below a red heat.

Silver fuses at	1873° Fah.	Pure iron	Fusible in wind furnace.
Copper ,,	1996° ,,	Nickel	
Gold ,,	2016° ,,	Manganese	
Cast-iron ,,	2786° ,,	Cobalt	
	White heat.	Palladium	

The following are almost infusible, and can only be melted by the greatest degree of heat produced by art:—

Molybdenum,	Titanium,	Rhodium,
Uranium,	Cerium,	Platinum,
Tungsten,	Osmium,	Tantalum.
Chromium,	Iridium,	

VOLATILITY.—Mercury, potassium, sodium, zinc, magnesium, cadmium, arsenic, and tellurium are volatile at comparatively low temperature, and others of the metals are also volatile at higher degrees of heat. All the metals are conductors of heat and electricity. The best conductors of heat are named in the order and ratio of their conducting qualities, as follow:—

Silver =1000,	Tin = 145,	Platinum=84,
Copper= 736,	Iron = 119,	Bismuth =18.
Gold = 532,	Lead = 85,	

The best conductors of electricity are silver, copper, and gold, whilst iron, platinum, and lead are amongst the worst.

EXPANSION OR DILATATION.—All the metals are expanded by heat and contracted by cold. The following table, chiefly from experiments by Lavoisier and Laplace, indicates the linear expansion of the metals on being heated from the freezing point (32° Fahr.) to the boiling point (212°):—

Antimony, 1-193,	Iron, 1-819,	Silver, 1-524,
Bismuth, 1-719,	Lead, 1-356,	Tin (Falmouth), 1-462,
Copper, 1-582,	Palladium, 1-1000,	Tin (Malacca), 1-516,
Gold, 1-682,	Platinum, 1-1167,	Zinc, 1-340.

ALLOYS.—The compounds produced when two or more metals are fused together are called alloys, and the combination is a chemical union, not merely a chemical mixture; therefore, alloys differ considerably from the metals from which they were formed. Generally, but not always, the specific gravity of the alloy is greater than the mean of its components, and there is also a less bulk in the alloy, in consequence of the metals coming into closer union than when each was separate. In most cases, also, the smelting point of the alloy is lower than that of its individual metals, and alloys are generally harder and more sonorous. An alloy of 8 parts bismuth, 5 parts lead, and 3 parts tin will melt at the temperature of boiling water, whilst the melting point of any of the three taken separately is at more than double that heat.

By alloying manganese or gold with steel a great degree of hardness is produced, and an alloy of tungsten and steel is hard enough to cut through hardened steel itself. Both gold and lead taken separately are, as we have before stated, malleable, but if an alloy of the two is produced by mixing but half a grain of lead to an ounce of gold a brittle compound is produced. Copper and tin singly are not very sonorous, but fused together into an alloy they produce bell-metal. The description of the physical properties of the metals, generally, will be resumed in my next communication.

Shrewsbury, May 24. EDWARD GLEDHILL.

MINING IN THE NORTH PART OF MONTGOMERYSHIRE.

SIR,—It is a well-known fact to many now that this county is very rich—perhaps, indeed, the wealthiest in Wales—for its mineral. This has been already proved to a great extent by so many new mines springing up, and several old ones, that were abandoned for 30 years more or less, having re-started, with the greatest prospect of success. As I have lately been called to inspect some of them, it may not be out of place to put the facts before the public, and I intend, if you will kindly favour me, to send the result of my observation as often as I can to the Journal.

CAE CONROY MINE is situated within an easy distance to Llanbrynmair, and in close proximity to a railway station. It belonged to Sir John Conroy, who has sold it for 50,000*l.* or 60,000*l.* This mine has for at least 20 years returned handsome profits, and during the last few years has paid a dividend of about 12,000*l.* per annum. From the present appearance of the mine it will greatly add to the amount of profit; indeed, as it is in contemplation to reform the old system of drawing the ore to surface, and so much orey ground being developed, the returns can be easily quadrupled. Mr. Morgans, I believe, is the manager, and he is fairly entitled to the credit of bringing it to its present state of prosperity.

North of Cae Conroy is the RHIW MWYN MINE (also within a short distance of the same railway station), which is now being re-started by a London firm. As I shall shortly have occasion to go there I shall defer making any remarks until then.

North-west of Cae Conroy Mine, and about a mile therefrom, is the CWM NANT-DU MINE, which until lately has not been working for a great number of years. Mr. Kindom many years ago made a rich harvest of its produce, the bulk of which was obtained near the surface. Having been called there lately with a mining gentleman, I naturally enough noticed the workings which have been done. I found that the deeper workings have not been carried on the main lode, but by all indications this part turned out a good-paying lead ore, especially eastwards, as it approaches the other lode, and forms a junction with it. Having probably been misguided by this, they have left the main lode untouched in the deeper workings. By extending the crosscut 8 fms. further south the main lode will be intersected, and in driving eastwards a junction of lodes will be found. Seldom have I witnessed such a congenial and good-looking lode, very similar in its character to the productive and masterly lodes of Flintshire, without any of their elvan courses to disturb its wealth. In the 15 fm. level I observed a rich bunch of ore, composed entirely of carbonate of lime—so much so that I, being a stranger to the mine, could scarcely discern the ore, which was hidden under the coat of lime; when I took the pick and broke it down its produce quite astonished me—a finer lump of lead ore I never saw in any mine. As the workmen are now engaged in opening old workings more valuable orey ground is being developed, and I am confident, from a scrutinising inspection, that this mine before long will find its place in that golden column of your paper—the Dividend List. It surprises me how they abandoned it, and that within a few fathoms of the main lode. But it is a noted truth, that very frequently while some have laboured others come and reap the benefit. In a winze sunk on the lode in the bottom of another level I found the water heavy, but I noticed a good course of ore going down towards the deep cross-cut level south, which will shortly tap the water, and will give the proprietors a large quantity of ore to take away, and will also fully ventilate the bottom workings. I was lately told this mine has been sold for a few hundreds of pounds; but, bear in mind, my prediction is that in a few months hence it will prove a vast financial success to the purchasers. Other mines which come under my notice in my next. G. L.

May 23.

THE FUTURE PROSPECTS OF WHEAL BASSET.

SIR,—I have been much interested and also amused with the many vague reports and false prognostications which have been floating in the mining hemisphere of late concerning Wheal Basset; but this famous old mine, like a voyager's ship, has enjoyed many a bright and sunny day, as well as hours of apparent gloom and predicted adversity, which its prognosticators have magnified into the prelude of a tremendous and destructive storm. But I am happy, Sir, to inform the mining public through your widely-circulated Journal that this gallant old ship (Wheal Basset) has rode majestically and triumphantly over the predicted storm of its would-be prophets, and that it is now emerging forth rapidly into the bright and sunny sea of prosperity, destined to enrich the coffers of its spirited adventurers, which they so well deserve.

About three years ago the agents, in conjunction with the committee, plainly foresaw that there was a vast amount of reserve tin ground, of comparatively low produce, which could be taken away with great profit to the adventurers, provided that there were a stamps erected on a large scale, dressing-floors laid out on the most economical and improved system, and the tramway on the surface made of easy transit, so as to convey the tinstuff from the different shafts to the stamping-mill with the least possible expense; but to accomplish this important undertaking it would require the enormous sum of 15,000*l.* After due consideration the task was undertaken and prosecuted with the greatest ardour and diligence, which confers honour on all who were concerned in it. The result of this important undertaking is now plainly seen in the fact that the returns of mineral are rapidly increasing. Formerly the returns of tin were about 20 tons per month, but now they are increased to more than 30 tons per month, and realising over 80*l.* per ton. The copper, which a little while ago was about 100 tons per month, is now increased to more than 150 tons per month, so that the 15,000*l.* outlay will be soon cleared off the balance-sheet without one single call being made, and in five or six months it will again enter the list of dividend mines, and amply remunerate the adventurers for their praiseworthy conduct in such an important and noble undertaking.

This famous old mine is situated in one of the richest and most productive channels of ground in the county: it is about three-quarters of a mile in length, and nearly equal in width. There are upwards of a score of lodes traversing the mine, through easy and accessible ground, the nature of the locality being so productive of tin ore that carbonas are often met with even between the lodes, where rich deposits of tin are found. Several of the lodes have already begun to change their underlie, so that they are converging to one point, and when the junction of these lodes takes place there is every probability of meeting with a rich deposit of ore, which will greatly enhance the value of the mine, and become a precious boon to the adventurer. Keeping this object in view (the conjunction of the lodes), they have already commenced operations to sink the engine-shaft, which is to be prosecuted with the greatest vigour.

They are already working in this extensive mine between 80 and 90 pares of tributers, varying from 1s. 6d. to 13s. 4d. in 1*l.*; and also upwards of 40 pares of tutwork men, in addition to the 240 hands on the surface—so that the labour cost exceeds 1700*l.* per month, which bestows a great blessing on the neighbourhood. In conclusion, I would congratulate the adventurers on the hopeful prospect which lies before them. With good management, energetic prosecution of the mine, and a good standard for tin, I doubt not but Wheal Basset will be one of the most lasting and prosperous mines in the county.

May 21. A PRACTICAL MINER.

GENERAL MINING ASSOCIATION.

SIR,—Having seen in last Saturday's Journal a short account of my address to the shareholders of the General Mining Association, at their meeting on May 11, I trust you will afford me space in your next issue to explain what I intended to have said had I not been called to order by the Chairman.

That there is no doubt whatever of the value of the General Mining Association's property; that they have got coal fields practically inexhaustible; that their coals bring a higher price at Halifax than any other Nova Scotian coals, and the consumption in the Province of Nova Scotia alone ought, even in the present depressed state of the British American coal trade, to return a dividend to the shareholders if the mines were properly managed.

That the working expenses in England amount to 5893*l.* 4s. 4d. for last year—or nearly 1¼ per cent. on the gross capital of 559,300*l.*

That the office expenses in London are 1870*l.*, while the bulk of the work is, or ought to be, done in Nova Scotia.

The directors pay 300*l.* a year for an unfurnished office, and have furniture valued at 300*l.*, a secretary, and a staff of clerks.

That the prosperous Cunard Company do their London business in the company's offices, their door-plate quite overshadowing that of the General Mining Company, and that not one penny of rent appears in the accounts as having been levied by the directors. I trust that Messrs. Cunard will not now object to pay up for last and former years.

That there is a board of six directors, crediting themselves with large salaries when they are not returning any dividend.

The expenses in Nova Scotia, besides the working expenses, are 12,649*l.* 1s., or upwards of 2¼ per cent. on the gross capital, making in all upwards of 3¼ per cent. on the aforesaid capital.

That three steamers, valued at 7325*l.* 5s. 8d., are kept up at a heavy loss. If it is necessary that the company should provide tugs for the purpose of towing colliers in and out of harbour a private firm could easily be found to perform these duties for a small subsidy, and thus save the company the greater part of the expenses under this head.

That machinery, &c., was sent from England last year to the gross amount of 7005*l.* 11s. 6d., with a decreasing trade, and when the company has already spent such large sums on plant. Equally good machinery could have been purchased, if necessary, at Halifax cheaper.

That the sum of 1500*l.* a year is paid to Messrs. Cunard and Morrow as Halifax agents, besides a sum of 998*l.* 8s. 10d. which appears as bad debts in Nova Scotia, and commission on sales in the United States, 700*l.*

All these salient points I wished to lay before the shareholders, and to propose—

1.—That the London board should consist of three directors, to be paid by a small percentage on profit.

2.—That the secretary should be paid a sum (say, 300*l.* a year) to provide office, stationery, &c.

That there should be a sub-board at Halifax, consisting of Mr. Wm. Cunard, and two eminent Halifax merchants.

4.—And that a first-class mining engineer and financier should be sent out as agent to Halifax, whose sole duty should be to control expenditure and effect sales, with a small salary and commission on sales, under the supervision of the Halifax board.

Should these suggestions be carried out, I am confident that in twelve months the shares of the company would be again at par.

35, *Dorset-square, May 24.* CHAMPAGNE L'ESTRANGE, Captain R.A.

GENERAL MINING ASSOCIATION.

SIR,—My attention has been directed to the report contained in last week's Journal of the extraordinary general meeting of the General Mining Association, and from which incorrect inferences might be drawn. I have, therefore, applied to the secretary for a copy of the minutes of that meeting, by which you will observe that,—by your previous report, it would be inferred my views were not in accordance with the general opinion, and that I was in a hopeless minority, whereas it will be seen that my amendment was only lost by two votes; and if the votes of the directors, committee, and officials had been eliminated I should have had a considerable majority of independent proprietors in my favour. The proprietors will be doubtless pleased to learn that it has been since determined to print the report *in extenso*, and that it will be in their hands within a fortnight.—*Union Club, Trafalgar-square, S.W., May 26.* J. C. RUDING.

P.S.—My amendment having been lost, most of my supporters refrained from voting on Col. Weston's resolution.

[For remainder of Original Correspondence, see this day's Journal.]

IMPROVED GRINDING AND MIXING MILL.—A material improvement has just been effected by Messrs. John Fletcher and Sons, of the Eagle Foundry, Salford, in their patent grinding and mixing mill, which first came into use about 18 months ago. For the use of a mining company the firm have recently completed, with all their latest improvements, one of most uncommon size, which we have had an opportunity of seeing in operation. Its circular dish, which revolves smoothly and with the least possible friction upon conical rollers, is 12 ft. in diameter, and the total weight of the machine is 30 tons. This includes two large crushing rollers, of 4 tons each, turning above the edges of the basin on their own axes, and these can be either raised or lowered at will, according to the pressure required. With a remarkably small degree of steam-power the machine can be kept in rapid motion, grinding stones, brick, coal, sand, or other hard substances to the finest powder when necessary. It seems adapted to mix mortar or pulverised minerals of any kind with equal efficiency, appliances being used to protect the bearings from getting clogged with adhesive grit. The novel feature that now more especially calls for notice is the "self-acting discharging apparatus" which has been attached to the machine, Hitherto the material ground in such mills has had to be emptied out of the trough with spades by labourers standing constantly by for the purpose. Thi

labour may, however, be now saved by Messrs. Fletcher's most recent addition to their useful and ingenious patent. The delivery slide, by means of which this can be accomplished, is made to rest on its centre across one side of the dish. When required, one end of this appliance can easily be lowered until it reaches the bed or floor of the revolving trough. There the mortar or crushed substances are gathered in and carried along the slide to wagons which may there be in waiting to carry it off. This is done by means of scrapers or scoops, which are run along the slide upon endless chains. Attached to the outer end of the discharging apparatus is fixed what is called a "doctor," a small metal plate, which thoroughly cleans each scraper as it rises.

FOREIGN MINING AND METALLURGY.

The metallurgical markets of France have shown rather more animation during the last few days; at the same time affairs have not regained their regular current. Paris seems to have much difficulty in deciding on passing orders into the Haute-Marne. At Lyons and in the South, on the contrary, the demand is more sustained. Upon the whole, rolled merchants' iron remains in little demand, while machine and special iron enjoy a certain favour; for axles also there is a fair enquiry. It is announced that several establishments in the Champagne district have been obliged to reduce their production by reason of the drought which has prevailed. In the Moselle the favourable state of metallurgical industry, previously reported, continues; everywhere employment is abundant, and prices display much firmness. The canal lateral to the Moselle is now in operation as far as Pont-à-Mousson, and boat loads of coal, coke, and sand are now received by it at the Pont-à-Mousson works. The Pont-à-Mousson works are to deliver cast-iron columns for six furnaces, which are about to be constructed in the Luxembourg and in France, by MM. Metz, of Dommeldange, and the concessionnaires of a line from Longwy to Esch. There is a strike of working iron-founders at Paris; at a recent meeting they decided upon requiring that in future each man should be paid at the rate of 6d. per hour, and that work by the piece should be suppressed. It remains to be seen whether the employers will accept these conditions; probably they will not, but will prefer to send their work into the provinces, as they are now doing. The Bethune Mines Company is now paying its second dividend coupon for 1869, or 6s. per share. The Naval and Railway Blast-Furnaces, Forges, and Steel Works Company will pay, May 31, the balance of the dividend for 1868-9, or 6s. per share.

The Belgian coal trade does not show much change, except that the extraction has been somewhat reduced, in consequence of a number of men having left their places in collieries in order to go and work in brick-fields. Tenders have just been let for coal required for the Belgian State Railways. The contract prices secured for each description were sensibly higher than those obtained at the corresponding adjudication of 1869. In the case of some qualities the advance has been as much as 33 per cent., and the prices now obtained certainly bear striking testimony to the prosperous condition of Belgian coal mining industry. The Belgian iron trade has presented no very material change, the prosperity of the various works being still sustained. It must be remarked, however, that Prussia is making great efforts to reduce the quantities of railway *materiel* imported by her from abroad. Thus, powerful companies are being formed in Russia for the manufacture of rails and rolling stock, and as an essential condition in the granting of concessions for new lines imperial decrees stipulate that two-thirds of the rails and plant required shall be purchased from Russian works, only one-third being allowed to be imported from abroad. A report on the way and works of the Great Central Belgian Railway for 1869 states several points of interest. The report observes that it has been abundantly and decisively proved that iron rails cannot present sufficient resistance on those parts of the system where the gradients are sharp, and where the traffic is considerable. Bessemer steel rails have there been tried upon the Lodelinsart and Marcinelle incline, which is the sharpest upon the network. The steel rails laid down are found to resist much better the strain which they have to sustain, but it is feared that the polish which they acquire after having been in use for a certain time prejudicially affects the adhesion of the engines, and the action of the breaks. Experiments are being made this year in order to throw further light upon this important point. The management of the Great Central Belgian has come to the conclusion that Vignoles rails are the best devised for securing strength and resistance; at the same time it is observed that the cause of defects in rails is not to be found only in their shape, but also in the bad quality of the iron of which they are composed, or the imperfect manner in which they are rolled. Iron sleepers have been tried with satisfactory results upon the Great Central Belgian system. In 1869, 1538 new iron sleepers (Wautherin's patent) were laid down, and it was found that the portion of the way upon which these sleepers were in use required much less attention than that on which ordinary wooden sleepers were laid. No iron sleeper which had been laid was rejected in the course of 1869 as having become past further service. The North of Charlerol Collieries Company will pay, on June 1, a dividend of 16s. per share. The Sambre and Meuse Mines and Iron Works Company will pay, on July 1, a dividend for 1869 of 8s. per share. The Vieille Montagne Company is now paying 8s. per share, as the balance of the dividend for 1869.

The permanent way of the old network of the Northern of France Railway was renewed last year with new rails to the extent of one-eighteenth of the whole quantity of rails originally laid down, so that in eighteen years this portion of the system will be entirely renewed at the present rate of renewal. The administration also continues to introduce steel rails in those portions of the system over which the heaviest traffic passes. Some intesting remarks are made on the French coal supply question by M. Lacretelle in a paper published by the "Bulletin de la Société de l'Industrie Minerale." M. Lacretelle states that the consumption of Prussian coal is increasing in France more rapidly than that of English coal, while English coal appears to be gaining favour among the French rather more rapidly than Belgian. M. Lacretelle estimates that the amount of capital set fast to secure the production of each ton of coal raised in France is 1*l.* 4*s.* Taking an average of eleven years from 1855 to 1866 inclusive, M. Lacretelle states that the Aniche mines yielded an average profit of 3*s.* 2*d.* upon each ton of coal extracted. Of this 3*s.* 2*d.* per ton, 1*s.* 11*d.* per ton found its way into the pockets of the proprietors of the mines in the shape of dividends, and the balance was applied to first establishment expenses. Messrs. Bolckow, Vaughan, and Co., of Middlesborough, have obtained an order for rails, fish-plates, &c., for the Netherlands State Railways.

The Vieille-Montagne Zinc Mines and Foundries Company increased its production of zinc last year to 43,036 tons, as compared with 40,216 tons in 1868, 36,260 tons in 1867, 31,722 tons in 1866, and 30,592 tons in 1865. This great production, which amounts to 30 per cent. of the whole zinc production of Europe, would not have been attained merely with the minerals obtained from the company's own mines, but the directors supplied, to some extent, the consumption of the company's furnaces by means of purchases made abroad. The sales effected by the company on the various European and over-sea markets have followed the progress of the production, having amounted last year to 44,441 tons, of which 37,957 tons were zinc, properly so called. In the total of 37,957 tons, France alone figured for about half, Germany, Belgium, and Holland for one-fourth, and England, the United States, and other over-sea markets for the other fourth. The selling price of zinc last year was below that of 1868, but this element of loss was compensated for by a greater production and economies realised in the manufacture. Among the general causes which for several years past have tended to occasion a decline in the price of zinc, we should mention the great production of calamines in Sardinia, which has augmented, by more than 20,000 tons per annum, the general production of rough zinc in Europe during the last three years, and has disturbed the equilibrium which formerly existed between the production and consumption. The net profits realised by the company amounted last year to 124,846*l.*, and the dividend for 1869 is 16*s.* per share, absorbing 90,000*l.* This dividend shows some little improvement upon that paid for 1868, and the company's position seems to have improved generally during the last 12 months.

The New York papers are despondent about the condition of the shipbuilding interest in the United States. It is said that no better commentary upon the decay of American navigation interests can be had than is afforded in the fact that the Novelty Iron Works have sold off most of their machinery and tools; the Allaire Works are now occupied as a stable; the Etna Works have ceased to make marine steam-engines; the Fulton Iron Works are for sale; W. H. Webb's shipyard is to let; Henry Steer's yard is empty; the Continental Iron Works are almost deserted, and green grass is growing in nearly all the shipyards, which a few years ago were filled with workmen.

AUSTRALIAN GOLD MINING REPORTS.—We have been favoured by the Secretary for Mines, Mr. R. Brough Smyth, with the reports of the mining surveyors and registrars for the quarter ending December, 1869. The total quantity of gold got was—from alluviums, 232,255 ozs.; and from quartz, 162,631¼ ozs.: together, 394,886¼ ozs., raising the total for the year to 1,544,757¼ ozs.; the quantity exported during the year was 1,340,838¼ ozs. In the central division of the Ballarat mining district there was a falling off in the amount of gold obtained, but to show that no want of confidence exists in the locality Mr. Harrie Wood (the registrar) states that building is going on continuously, and more business has been done at the saw-mills than in any previous year. In the Buninyong division Mr. R. M. Harvey reports that there has been a stoppage during the quarter of several prospecting companies; there is still, however, considerable activity displayed on the Hiscock's line of reefs. The average yield per ton has been within a fraction of 4 dwts. In the Smythesdale division Mr. John Lynch reports that there has been a yield largely in excess of any produced in an equal interval of time for some years back. This improvement is entirely due to the prosperous condition of the main lead from Scarsdale to Piggoreet, along which, for a distance of about three miles, there is an unbroken succession of claims, every one of which is at present giving magnificent returns. In the Creswick division Mr. James Stevenson reports that the yield of alluvial gold is considerably greater than it has been for some time past, caused chiefly by the increased yield of the deep ground at the Red Streak, and the different sluicing parties, who have nearly all washed up. In the Gordon subdivision alluvial mining is dull, but quartz mining maintains its position. In the Beechworth division of the Beechworth district sluicing operations, which were almost at a standstill, have improved during the quarter, a copious fall of rain having taken place; the amount of gold obtained has, consequently, come up to the average for the corresponding quarters of previous years. The prospectors for the tin lode at the Pilot have, up to the present time, been unsuccessful in their search for the lode, but they have discovered that a considerable breadth of country in that neighbourhood contains stream tin, or black sand, in large quantities; it is thought that could water be obtained in sufficient quantities for sluicing purposes it would pay well. Another lease for tin mining has been applied for at the Clear Creek, near El Dorado. Here it is intended to sluice the bed of the creeks and such portions of the adjacent banks and flats as will be likely to pay. The black sand found here is of a superior quality, and the company applying for this ground intend to work it by means of Chinese labour, which can be obtained here at about one-half the price of European labour. Mr. Hunt, with one of his diamond machines, has been successful in finding two small diamonds at Sebastopol, together with a number of zircons, garnets, and other precious stones; but the market value of the whole is very trifling. This gentleman thinks that gems of greater value may yet be found at the Woolshed, and is making preparations for working a portion of the creek systematically. In the Big River subdivision Mr. A. B. Ainsworth reports the rumour of the discovery of an antimony reef which has reached him, and which he proposes to visit when somewhat opened up, and report upon. Nothing remarkable is reported from the other districts.

AUSTRALASIAN GOLD.—The imports of Australasian gold into the United Kingdom in the first three months of this year have been on a very considerable scale, having amounted to 1,727,854*l.*, as compared with 1,000,420*l.* in the corresponding period of 1869, and 934,909*l.* in the corresponding period of 1868. In the whole of 1869 the imports amounted to 7,892,757*l.*; this total shows a considerable improvement upon that of 1868, which was 6,989,594*l.*, and also upon that of 1867, which was 5,801,207*l.* In the preceding nine years the value of the Australasian gold received in the mother country had been as follows:—1858, 9,064,763*l.*; 1859, 8,624,566*l.*; 1860, 6,719,000*l.*; 1861, 6,331,225*l.*; 1862, 6,704,753*l.*; 1863, 5,995,368*l.*; 1864, 2,656,971*l.*; 1865, 5,051,170*l.*; 1866, 6,839,674*l.* The rally which the returns for 1869 and 1868 indicate in the production is due to the opening out of further gold fields in Queensland, South Australia, and New Zealand.

MINING IN SOUTH AUSTRALIA.—The news from the mines in the northern district of South Australia is as favourable as could be desired, so far as the evidence of the existence of mineral is concerned, but the development of the mines is rendered almost entirely impracticable in consequence of the absence of means of communication between the Far North and Port Augusta. Mr. Bonney appears to infer that the Nuccaleena and other mines of the same district are bunchy, but observes that there are several mines around the Yudanamutana which would appear to be of a permanent character. Whether the mines be bunchy or not, it is considered beyond question that they contain an abundance of mineral, and that were means provided of getting goods and materials to the mines and produce down, they would yield ample profits. The Blinman is supporting 1500 persons, and it is estimated that they could send down 2000 tons per month from the Yudanamutana; and as these are but two of many equally rich properties, there would be plenty of traffic to remunerate those who might find capital for the line. The principal question which appears worthy of discussion is whether it would be preferable to construct a railway or a tramway, many considering that the only water obtainable is better adapted for watering horses than for supplying locomotives.

THE QUICKSILVER MINES OF ALMADEN.—There are altogether nine *pisos* (levels) which strike at various depths and in different places the veins of quicksilver. The Spanish name for these veins is highly expressive, *cruadero*, the literal meaning of which is the "breeding place," or matrix. These veins are each called by the name of a saint; thus we have San Diego, San Julian, San Francisco, San Pedro, &c. The ordinary thickness of these saintly veins is from 4 to 5 fms., and in places where they cross each other it is still greater. In all there are six veins, which run from east to west within a very trifling distance one of the other, with one exception—that of San Diego, which deviates from the ordinary direction, and describes part of a large circle. The richness of the ore varies not a little in the different *cruaderos*, and the same mine exhibits often a remarkable diversity of yield in one *piso* compared with its yield in another. For instance, in the 7th *piso* (or level) the richness of the San Pedro *cruadero* (or vein) is 33·989 per cent. The same *cruadero* in the 8th *piso* gives a richness of 31·334 per cent., while in the 9th *piso* it has a richness of only 14·323 per cent. But San Nicholas is out of sight the richest of all the *cruaderos*. Its ore in places is nearly pure virgin quicksilver, that hardly needs to be smelted. In the 8th *piso* this saint has a richness of 83 per cent.; and in the 9th, 44½ per cent. We have no accurate data as to the regular annual yield of Almaden prior to the earlier years of the present century. During its two first decades the annual output was about 22,000 quintals of mercury, with a staff of 700 miners and 200 smelters. The *modus operandi* of the smelting was at once wasteful and pernicious to health. The ore yielded on the average from about 15 to 20 per cent., but there can be no doubt from the analysis that nearly one-half of the quicksilver was lost and dispersed in the air—to the great injury of the workmen's health—in consequence of the obsolete and inadequate apparatus of aludels employed in its sublimation, an apparatus which had remained without material change for the better since the days of the Moorish dominion. From an official document for the year 1866, we learn that the net produce of pure metal after smelting was 9550 metrical quintals, the money value being 19,775,000 escudos, or in round figures about 200,000*l.* There is now at Almaden a very prosperous school of mining. One of the chief evils in connection, not alone with these quicksilver mines, but with the mines of the whole Sierra Morena district, so rich in various minerals—want of facilities for transport—will be obviated by the new line of railway, which is rapidly approaching completion.

VALUE OF THE FOREIGN IRON TRADE.—The value of the steel and iron exported from the United Kingdom in the first three months of this year was computed at 4,240,458*l.*, or at the rate of 16,961,832*l.* per annum. It should be remarked, however, that the exports of iron to Russia are in great part suspended during the first three months of a year, so that the estimated total set down as likely to be attained in 1870 will, probably, be exceeded rather than otherwise. For the whole of 1869 the value of the iron and steel exported from these islands was 12,519,201*l.*, against 15,036,398*l.* in 1868, 15,050,391*l.* in 1867, 14,842,417*l.* in 1866, 13,471,359*l.* in 1865, 13,310,484*l.* in 1864, 13,150,936*l.* in 1863, 11,365,150*l.* in 1862, 10,326,646*l.* in 1861, and 12,154,997*l.* in 1860. The tendency of the yearly totals will be seen to be sensibly towards expansion.

The total of 19,519,201*l.* forming the aggregate for last year, was made up as follows:—Pig and puddled iron, 2,056,605*l.*; bar, angle, bolt, and rod iron, 2,684,071*l.*; railroad iron, 7,282,040*l.*; castings, 857,643*l.*; hoops, sheets, and boiler-plates, 2,253,600*l.*; wrought-iron of all sorts, 2,427,154*l.*; old iron for re-manufacture, 483,510*l.*; and unwrought steel, 1,038,800*l.*

THE AMOUNT OF GOLD IN THE WORLD.—The amount of gold in existence at the beginning of the Christian era is estimated to be 85,400,000*l.*; at the time of the discovery of America it had fallen to 11,400,000*l.*; it then gradually increased, and attained, in 1600, to 21,000,000*l.*; in 1700, to 70,000,000*l.*; in 1800, to 225,000,000*l.*; in 1843, to 400,000,000*l.*; in 1853 to 600,000,000*l.*; whilst the present amount is valued at 1,200,000,000*l.*, which, welded into one mass, could be contained in a cube of 26 feet. Of this amount, 800,000,000*l.* are estimated to be coin and bullion, 200,000*l.* in watches, and the rest in jewellery, plate, &c. A cubic inch of gold is worth (at 3*l.* 17*s.* 10½*d.* per ounce) 42*l.*; a cubic foot, 72,562*l.*; a cubic yard, 1,959,552*l.*

SEPARATING GOLD AND SILVER BY CHLORINATION.—The invention of Mr. F. B. MILLER consists in melting the bullion in a crucible, and passing into this through a pipe in the cover chlorine gas as long as chloride of silver is formed. This can then be poured off in a fused condition from the gold, which solidifies more quickly on cooling. The chloride of silver is reduced by plates of zinc, combined with slabs of chloride, into a galvanic arrangement. In 24 hours the chloride is completely reduced to spongy silver. No acid is required, and the zinc consumed is only 25 per cent. of the chloride reduced.

DISTILLING OILS FROM MINERALS.—The invention of Mr. G. BENNIE, of Kinning-park, Scotland, consists in introducing superheated steam by means of a peculiar appliance in such a way as, whilst acting on the vapour from the minerals by virtue of its heated condition, to also carry forward the vapour from the still or retort, and so serve as an efficient exhauster. The steam thus employed, and which may be heated to a temperature of 500° Fahr., or upwards, is introduced by means of a nozzle directed along the centre of the outlet-pipe from the still, or retort, and placed at or near the entrance from the still, or retort, into the pipe. The nozzle terminates in an expanding mouth, or cup, with which the bore of the pipe communicates by one or more, and by preference several, minute perforations, and this construction causes the steam to spread, so as to act more effectively on the vapour.

CARBONATE OF SODA.—The invention of Mr. C. F. CLAUS, of Middlesborough, consists in certain improvements in the manufacture of carbonate of soda, when such carbonate is made, by converting sulphate of soda into sulphide of sodium, and by decomposing solutions of sulphide of sodium by carbonic acid, and when this carbonic acid is obtained by the combustion of carbonaceous matter, such as furnace gases. The sulphide of sodium the inventor manufactures by heating the ordinary mixture of sulphate of soda, coal, coke, or other carbonaceous material by the aid of heat, generated by combustion of gaseous fuel, such as the waste gases from blast-furnaces, the gas-furnaces like, or similar to, Siemen's gas-furnace, or the gases from coke ovens, taking care that before, during, and after the combustion not more atmospheric air is admitted than is necessary to produce carbonic acid with the carbon in the said gases, so that after the heating of the sulphate and coke, or coal mixture, the products of combustion may serve as a source of carbonic acid, free from oxygen, to be used in the subsequent operations.

ELECTRICITY AS MOTIVE-POWER.—The invention of Mr. L. HICKES, of Liverpool-street, consists in providing and arranging one or more cylinders, chambers, or receptacles connected with batteries, by which means a current, or currents, of electricity is or are passed through each, or either, of them collectively, or respectively, at any desirable velocity, and the gases or atmospheric air therein decomposed, and vacuum produced by the action of each successive spark or sparks. Each cylinder is provided with a piston accurately fitted thereto, and connected by its rod either directly to a crank, cross-head, or other well-known means of communicating power to machinery generally; suitable valves are also introduced and applied for the free admission of air, and others for exhaust from the chamber of the water arising from the decomposition thereof.

The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE XLIII.—In my last lecture (said Mr. SMYTH) I put before you, briefly and hastily, a few of the facts connected with the removal of minerals underground, dealing almost entirely with the main roads, but looking at the means by which the broken material is removed and comes down to those main roads, sometimes by a declivity of considerable length, where the force of gravitation comes in to facilitate the application of horse-power, or to supersede it. I mentioned most of the improvements, short of the introduction of engine-power, which have been arrived at, and spoke of the use of railways underground as in vogue long before they were applied at the surface for the conveyance of merchandise and passengers. I pointed out that while at the surface a horse would, as a fair day's work, draw a load of 100 tons a mile, in the mine not more than 10 or 20 tons was drawn. One reason for this was the condition of the roads, the improvement of which so far differs from a mere matter of railway engineering in the fact that the continual upheaval of the floor creates a constant necessity for the relaying of the rails; and, in fact, an impossibility of maintaining the roads as they are easily done at the surface. If you have seen the admirable methods by which the movements are rendered smooth on the metropolitan railways, you might conceive it possible to keep the roads in a better state underground; but, in truth, the cases differ most materially. I have mentioned the cases in which levels are driven wide at first for the purpose of being employed as main roads, and kept open by pack-walling; but the expense of roads in a mine can only be described as perpetual, and often enormous, from the rising of the floors by the pressure from above on all sides, the falls of roof, and the cost of putting in and keeping up timber supports. Expenses of this kind are unavoidable and considerable, and it is not surprising, therefore, that every attempt has been made to reduce expenditure in those departments where economy is possible. Thus, the maintenance of a large number of horses in a mine was found to be a heavy burden, and the question whether it was feasible to introduce some mechanical agency in lieu of them became of importance. In most of the northern collieries fifty to eighty horses had to be kept, requiring extensive stabling underground, where (as in some places) they were not brought to the surface every night, and lowered every morning. For the most part, they were kept below, and many did not see daylight for twelve months at a time, and instances were not unfrequent where they were underground during their whole life-time. Then there must be an extensive farm attached, to supply them with food, or arrangements for a foreign supply of hay and oats, and down below a staff of persons to feed, and water, and clean the animals—to say nothing of veterinary attention. I can scarcely mention the intermediate steps which were taken, but most of the great northern collieries have been provided with engine-planes in all the main roads, upon which the wagons are driven by a stationary engine, placed at the bottom of the shafts. I do not know whether hydraulic power has been as yet much employed, but steam is used in various ways.

Canal conveyance was advocated by the great engineer, Smeaton, and others, as a great improvement over ordinary roads for heavy traffic, and no doubt it was so; but it was conceived that it might also prove of great advantage underground. In the last century, therefore, at several places levels were driven of extra size, puddled, and converted into canals. In Shropshire there is now a long level of this kind, which was designed to answer the double purpose of an adit and a means of conveyance, and which is called the "boat level." It was thought that, considering the large quantity of water which these levels often bring out, it would be a moderately cheap mode (where the geological conditions permitted) of bringing the valuable minerals to daylight. The boats are made flat and long, and the motive-power is obtained by means of a flat rope along the roof of the level, pulled at by a man who crouches in the bow of the boat. In some of these canals the mode of propulsion is not a little curious—for instance, in some places men called "leggers" lie on their backs on the top of the cargo, and push the boat along by the action of their feet upon the roof. In one or two of these ancient canals, as for instance, at Holywell, in Flintshire, visitors are floated into the interior of the mine, but they are often so close to the roof as to run a risk, if due care were not taken, to scrape their noses. At the celebrated Worsley Colliery, in South Lancashire, a water-level of this kind is carried in to a distance of several thousand yards; it is 8 ft. high, and 9 ft. wide. The roof is arched in places, and the thing is well done, but there is a difficulty of keeping up 4 or 5 ft. of water. In some of the Belgian mines, in the valley of Liége, in the Hartz mines, and at Clausthal they have these canals, but now-a-days they have often a rail running side by side with them. The whole value of such arrangements, it is obvious, must depend upon whether the use of an adit in this way will save the cost of raising the mineral to the top of the hill, and whether the conditions of the traffic will be best met at the point thus reached. The experience, however, of the last thirty years has established the rule that it is not worth while to go out of one's way to make such canals. Their decline was, no doubt, hastened by the exceeding slowness with which the mineral was moved, bearing no comparison with that of tramroads and railways. And so in the Hartz, where there is a canal 1000 fathoms in length; it would not now be tolerated, if the question of local convenience could be left out. We may, therefore, take it as a matter of certainty that very few water-levels of this kind are likely to be made in future.

Engines are sometimes placed at the surface, and the power is applied by means of a steam-pipe. In other cases a double engine is employed, with two cylinders resting on bed plates, with a heavy fly-wheel, placed near the bottom of one of the shafts, by means of which a drum is made to revolve and haul the trams of wagons by an endless chain. There has been considerable discussion as to which is the most economical mode of working. I can only say on this point that the method used in the North of England, in which the haulage is done by a simple rope, with a tail rope attached to the train, is very effective, and is worked with considerable advantage with long trains of carriages, and that from 25 to 50, and sometimes as many as 100, carriages are thus drawn at a rate varying from five or six to eight or nine miles an hour, and sometimes under circumstances which preclude the use of the ordinary railway. Where a water-wheel can be employed to turn the drum, this system of haulage is very economical. Elaborate calculations have been made as to the comparative cost per ton of different systems, but where the roads are tolerably straight and well kept, the endless chain seems likely to have the preference. In making an estimate of what the cost of underground carriage will be, it must be remembered that at the commencement of a colliery the distance over which the coal has to be removed is small compared with what it will be hereafter. An average, therefore, should be arrived at, and thus every item of expenditure can be tested, and should be watched with great care and jealousy by the mining engineer.

I may hear take the opportunity of saying a few words on the subject of mining engineers. Everybody now-a-days calls himself an engineer, from the man who plans a railway or makes a steam-engine, to the man who greases the wheels or stokes the fire, but the term "mining engineer" has a different meaning in districts. Thus, it is common in some places to call the general manager of a mine the mining engineer, although he may not be competent to take the direction of works of a purely engineering character. In the North of England such a person is called "a viewer," and he will generally be found to be a man of sufficient knowledge and experience to manage a colliery. In Cornwall and Devon a mining engineer is understood to be a man who has acquainted himself practically and theoretically with mechanics, and who is able to construct for himself, if need be, the engines he requires, but the man who directs the operations of the mine is called the captain. In our colonies, and in distant parts of the world, it is highly requisite for a mine manager to be able at least to direct the construction of machinery. Of course, in England, and for the most part in Europe, all kinds of machinery may be had to order, but the mining engineer should be able to judge of the quality of the material employed, and when we come to consider the raising of material in the shafts, it will be seen that he really ought to have a knowledge of mechanics, and of the application of mechanical power, whether derived from water or steam.

THE COAL MEASURES OF NOVA SCOTIA AND ENGLAND.

ON THE STRUCTURE AND AFFINITIES OF SIGILLARIA, CALAMITES, AND CALAMODENDRON.

By J. W. DAWSON, LL.D., F.R.S., F.G.S., Principal and Vice-Chancellor of M'Gill University, Montreal.

The object of this paper* was to illustrate the structure and affinities of the genera above named, more especially with reference to the author's previous papers on the "Structures in Coal" and the "Conditions of Accumulation of Coal," and to furnish new facts and conclusions as to the affinities of these plants.

With reference to Sigillaria, a remarkably perfect specimen of the axis of a plant of this genus, from the coal field of Nova Scotia, was described as having a transversely laminated pith of the Sternbergia type, a cylinder of woody tissue, scalariform internally and reticulated or discigerous externally, the tissues much resembling those of Cycads. Medullary rays were apparent in this cylinder; and it was traversed by obliquely radiating bundles of scalariform vessels or fibres proceeding to the leaves. Other specimens were adduced to show that the species having this kind of axis had a thick outer bark of elongated or prosenchymatous cells. The author stated that Prof. Williamson had enabled him to examine stems found in the Lancashire coal field, of the type of Binney's Sigillaria vascularis, which differed in some important points of structure from his specimens; and that another specimen, externally marked like Sigillaria, had been shown by Mr. Carruthers to be more akin to Lepidodendron in structure. These specimens, as well as the Sigillaria elegans illustrated by Brongniart, probably represented other types of Sigillarioid trees, and it is not improbable that the genus Sigillaria, as usually understood, really includes several distinct generic forms. The author had recognised six generic forms in a previous paper, and in his "Acadian Geology;" but the type described in the present paper was that which appeared to predominate in the fossil Sigillarian forests of Nova Scotia, and also in the mineral charcoal of the coal beds. This was illustrated by descriptions of structures occurring in erect and prostrate Sigillariæ, on the surface of Sternbergia-casts, and in the coal itself.

The erect Calamites of the coal formation of Nova Scotia illustrate in a remarkable manner the exterior surface of the stems of these plants, their foliage, their rhizomata, their roots, and their habit of growth. Their affinities were evidently with Equisetaceæ, as Brongniart and others had maintained, and as Carruthers and Schimper had recently illustrated. The internal structure of these plants, as shown by some specimens collected by Mr. Butterworth, of Manchester, and soon to be published by Prof. Williamson, showed that the stems were more advanced in structure than those of modern Equiseta, and enabled the author to explain the various appearances presented by these plants, when the external surface is preserved wholly or in part, and when a cast of the internal cavity alone remains. It was further shown that the leaves of the ordinary calamites are linear, angular, and transversely wrinkled, and different from those of the Asterophyllites, properly so called, though some species, as A. comosus, Lindley, are leaves of calamites.

The Calamodendra, as described by Cotta, Binney, and others, and further

* Read at the Geological Society of London, on May 11.

the Cornish rocks and minerals are at present little understood. On these, as on many other cognate questions, works like those at Ballycummisk may be expected to throw much light.

West of Ballycummisk, and immediately east of Schull Harbour, is situated Coosheen Mine, where there appear to be no less than eleven lodes, which some years since were proved and worked upon. All these are east and west lodes, varying in their bearing of direction from 10° east to 25° north. Seven of the eleven are copper-bearing, containing either yellow, purple, and grey ore, or green carbonate, and underlay or dip south. The sett is traversed from north to south by a cross-course or fault, accompanied by a parallel and well-determined flookan, which seems to have shifted the lodes. The killas to the south of the Coosheen dips north 40° to 60°, implying that the mine is situated in a synclinal axis, parallel to the Ballydehob anticlinal, and may be the north dip to the north-west face of the anticlinal, which runs south of Ballycummisk Mine and through Rossbrin Cove. No less than five faults traverse the copper-bearing zone of the Upper Old Red Sandstone, between Cappagh Mine on the east, and Schull Harbour on the west, and the lodes of Ballycummisk and Coosheen are all more or less affected by them.

It may be important to state that, at 42 fathoms from the surface, and 16 fms. below the deep adit, the No. 6 or old lode dipped south 6° in 1 (or 80°), and contained a leader of 7 in. of solid grey copper—the remaining 6 feet of the lode being composed of "quartz, grey copper, green carbonate, and blue peach." Even at the limited depth or shallow working mentioned upwards of 20,000*l.* worth of copper ore has been returned. It is believed, from the nature of the lodes, that Coosheen will be carried down to depths equal to that of Ballycummisk, for it cannot be doubted but the lodes of both setts are the same, and all are more or less parallel to the strike of the Upper Old Red beds; and such appears to be the law as regards the position and run of the lodes in the South-West of Ireland.

This is further shown by a recent report made by an able and experienced investigator, who states as follows:—"The investigations made by me in this mine enable me to state positively that the mineral deposits of Coosheen Mine are true mineral lodes, in the full acceptation of the term. I am informed that over 20,000*l.* worth of copper ore was returned in the prosecution of these shallow workings. It will be seen on reference to plan C that both elvan and flookan have performed their part in intensifying the mineralisation of the whole of these deposits, and causing the development of the large shallow deposits which have been discovered, and to the attainment of which, at any sacrifice of future success and facility of working, the efforts of previous explorers appear to have been directed; and I am of opinion that, in the headlong rush after immediate returns, the true and solid products possessed by the mine (as a mine) have been both passed by and left undisturbed below."

The latter words are true, we fancy, of many an Irish mine, but such results as these show that there is a good time coming, when, to quote the words of the author of the paper, "it is evident that, with a thoroughly organised system of mining, based upon known local laws and conditions, and with capital properly employed, the South-West of Ireland will take a prominent place in the history and practice of mining."

THE SOUTH STAFFORDSHIRE COAL FIELD.

THE SANDWELL PARK MINING SCHEME.

SIR,—Whenever any new scheme of any kind is set afloat, it is astonishing to witness the great multitude of spectators, some professing large faith and hope, wishing the scheme all the success it deserves. Others, who are hard of belief, and are ever desponding, and looking at the "dark cloud" rather than the "silver lining," behold the passing event as something presumptuous and ridiculous. Some look on it from the "dog in the manger" point of view; others from an equally selfish one. During the past few weeks no scheme has been subject to criticism more than the Sandwell Park Mining Scheme. While not a few of our *acknowledged savants*, professing faith and hope, based upon scientific deduction, give or take a favourable view of the scheme, a lot of lesser lights come forward, without the slightest modesty, and announce to the world at large their opinions concerning the undertaking and its supporters. One, of the name of Mr. Laxton, writes to local papers in a style certainly unique. He challenges a certain person (and I suppose the public too) to find any indication "of the Thick coal, or any other," existing at Sandwell, on the Geological Map; or if he (and I suppose they) "can find me where Sir Roderick Murchison's or the late Beete Jukes's theory upon this matter says the Thick coal does exist there, and at what depth; but that he will find their views are a matter of probability and doubt respecting it." With regard to the Geological Map showing the presence of Thick or other coals under Sandwell, I can only say that Mr. Laxton does not at all appear to know anything about the construction, colouring, and general arrangement of the invaluable Ordnance Maps. The Geological Map gives every reason for supposing that our South Staffordshire coal field does extend underneath the Permian Sandstone of Sandwell estate. Sir R. Murchison gives his opinion not only in his works, but in a letter written by himself to a friend of mine within the last three months, which *brochure* I have seen and read, that coal will be found under the estate in question. Our much-lamented friend Beete Jukes held the same opinion.

As to the following ingeniously puzzling piece of composition, there is nothing in it to warrant the deduction of Mr. Laxton:—"I have taken my views, and given opinions, from actual facts underground, *which is a clear proof to all geological theory** of the trial heads driven in the direction of this estate, along the western side of the great eastern fault, and the result was no coal." Mr. Laxton forgets (perhaps) to inform the public of the many 100 yards that have been stripped in the same direction, leaving a fine rib of good Thick coal.

I could show Mr. Laxton—and others can too—where in a property of only a few acres heads have been driven with the same results as he mentions, but within a trifling distance the disturbance has been passed through, and all minerals been found as before.

It appears to me very absurd to condemn, *in this particular circumstance*, an estate containing over 1000 acres, because a small head or two, not more than 6 feet wide, have been driven "in the direction of this estate," and proved no coal.

I question if Mr. Laxton can give any authentic details respecting this heading. After this general and sweeping condemnation Mr. Laxton, in the same breath, says—"My theory still is that this fault is the splitting up of the Thick coal into different beds on its eastern side, and that it is probable that they will meet with coal in the sinking, the working of which will remunerate them for the outlay; but not a Ten-yard coal, and at what depth under the Permian formation is a matter of doubt also, to which my paper alludes." This is strange logic, strange reasoning—it is like inflicting a wound, then denying that the wound exists, and afterwards actually applying a remedy to cure the wound.

We would not for a moment defend the scheme from public criticism, but when we find such effusions of unfair and unjust critiques, we only do an act of public justice by dissecting them, and showing their fallacies. The proposed scheme is a noble one, science as far as it can favours it, and every person who can boast of a grain of good sense must admit that the proposed means for carrying it out are the very best that can be adopted. Any way it will give to science a valuable wrinkle, and if successful will re-invigorate the strength of our "Black Country," and bless it with the freshness and vigour of youth, which is "a consummation devoutly to be wished for."—*Willenhall, May 25.* T. PARTON, M.E., F.G.S.

* Italics are mine in this case.

GUN-COTTON, DYNAMITE, AND OTHER EXPLOSIVES.

SIR,—I have read the correspondence relating to Explosives with some interest, and particularly the letter signed "W. O." in the Journal of May 7. I fully expected, after the very serious charges made in it against Prof. Abel, that either he or someone for him would have written you something to remove from him the very grave charge that he, a Government official, being at the same time largely interested (directly or indirectly) in the manufacture of Gun-Cotton, used his influence with the Home Secretary to pass as a Government measure the Nitro-Glycerine Bill of last session, by which means all the more powerful explosives, excepting only Gun-Cotton, are excluded from use. If the statements in that letter are true, it is Col. Boxer over again in an aggravated form, and such a state of things should not be allowed to exist, particularly by a Liberal Government, for one day. No doubt a measure was necessary to prohibit the storing of Nitro-Glycerine in large quantities, as also its transit, but when it has been proved, by Mr. Horsley's patent, that in combination with other substances it can be rendered quite safe, it is a very great hardship upon the owners of patents granted by Government, and for which large sums have been paid, that by this Nitro-Glycerine Bill they are shut out from using their inventions at all.

I have tried Dynamite on several occasions, and can quite confirm all that has been said about it for its safety; but there *is* a feeling *against* it among miners, and based on the fact that in close workings or in ill-ventilated shafts the *fumes* are noxious, which is applicable also to Gun-Cotton. This objection, however, does *not* apply to Mr. Horsley's recently-patented Blasting-Powder, which I have no hesitation in saying is stronger than Dynamite, and equally safe for all practical purposes, and enables and permits the miner to resume work *immediately* after a blast; but that able and scientific gentlemen, after devoting many years of his life to the invention and perfection of Explosives, is for the present at least precluded from making use of his discoveries, because his powder contains a *small* portion of Nitro-Glycerine, mixed with chlorate of potash, &c. The fact is that Prof. Abel is the only chemist employed by the Government that has any *practical* knowledge on the subject; the others, though men of undoubted ability, not having turned their attention to the subject, and not caring to do so, cannot give a satisfactory opinion as to the invention. I hope that Prof. Abel will in some way take notice of the letter of "W. O.;" as certainly, if it is not founded on fact, he should not permit such a statement to remain uncontradicted. C.

THE METALS AND THEIR ORES—No. III.

SIR,—DUCTILITY.—The malleable metals are ductile, and the most perfect of them may be drawn into wires of almost any length or size. Gold exhibits this property to the greatest extent, and a single grain may be drawn into a wire 345 ft. long, Dr. Wollaston even succeeded in obtaining 700 ft. of wire from 1 gr. of gold. Six of the most ductile of the metals are—

Gold,	Platinum,	Nickel,
Silver,	Iron,	Copper.

The brittle metals are not ductile.

TENACITY, or the power of sustaining weight or strain, is another property enjoyed by the malleable and ductile metals, but not, however, in the order of their malleability or ductility. Iron is the most tenacious of all the metals, and a wire 1-36th of an inch diameter will bear a weight of 60 lbs.; lead is the least tenacious of the ductile metals. Guyton Morveau, by a series of carefully-conducted experiments, ascertained, by noticing the greatest weight that different wires of a uniform size would sustain without breaking, that each wire of 0·787 of a line in diameter was capable of supporting weights as follows:—

Iron	549·250 lbs.	Gold	150·753 lbs.
Copper	302·278 ,,	Zinc	109·549 ,,
Platinum	274·320 ,,	Tin	34·630 ,,
Silver	187·137 ,,	Lead	27·621 ,,

HARDNESS is another quality in the relative degrees of which the metals vary considerably. Titanium, manganese, iron, nickel, copper, and palladium are amongst the harder metals. Gold, silver, and lead are softer than these, whilst potassium and sodium are the softest of the metals.

FUSIBILITY.—The metals differ as much in fusibility as in tenacity, density, or hardness. The following table gives the point of fusion of the different metals:—

Mercury	39° Fah.	Cadmium	442° Fah.
Potassium	136° ,,	Bismuth	497° ,,
Sodium	194° ,,	Lead	612° ,,
Lithium	356° ,,	Zinc	773° ,,
Tin	442° ,,		

All the above, including antimony, arsenic, and tellurium, are fusible below a red heat.

Silver fuses at 1873° Fah.	White heat.	Pure iron	Fusible in wind furnace.
Copper ,, 1996° ,,		Nickel	
Gold ,, 2016° ,,		Manganese	
Cast-iron ,, 2786° ,,		Cobalt	
		Palladium	

The following are almost infusible, and can only be melted by the greatest degree of heat produced by art:—

Molybdenum,	Titanium,	Rhodium,
Uranium,	Cerium,	Platinum,
Tungsten,	Osmium,	Tantalum.
Chromium,	Iridium,	

VOLATILITY.—Mercury, potassium, sodium, zinc, magnesium, cadmium, arsenic, and tellurium are volatile at comparatively low temperature, and others of the metals are also volatile at higher degrees of heat. All the metals are conductors of heat and electricity. The best conductors of heat are named in the order and ratio of their conducting qualities, as follow:—

Silver =1000,	Tin = 145,	Platinum=84,
Copper= 736,	Iron = 119,	Bismuth =18.
Gold = 542,	Lead = 85,	

The best conductors of electricity are silver, copper, and gold, whilst iron, platinum, and lead are amongst the worst.

EXPANSION OR DILATATION.—All the metals are expanded by heat and contracted by cold. The following table, chiefly from experiments by Lavoisier and Laplace, indicates the linear expansion of the metals on being heated from the freezing point (32° Fahr.) to the boiling point (212°):—

Antimony, 1-193,	Iron, 1-819,	Silver, 1-524,
Bismuth, 1-719,	Lead, 1-356,	Tin (Falmouth), 1-462,
Copper, 1-582,	Palladium, 1-1000,	Tin (Malacca), 1-516,
Gold, 1-682,	Platinum, 1-1167,	Zinc, 1-340.

ALLOYS.—The compounds produced when two or more metals are fused together are called alloys, and the combination is a chemical union, not merely a chemical mixture; therefore, alloys differ considerably from the metals from which they were formed. Generally, but not always, the specific gravity of the alloy is greater than the mean of its components, and there is also a less bulk in the alloy, in consequence of the metals coming into closer union than when each was separate. In most cases, also, the smelting point of the alloy is lower than that of its individual metals, and alloys are generally harder and more sonorous. An alloy of 8 parts bismuth, 5 parts lead, and 3 parts tin will melt at the temperature of boiling water, whilst the melting point of any of the three taken separately is at more than double that heat.

By alloying manganese or gold with steel a great degree of hardness is produced, and an alloy of tungsten and steel is hard enough to cut through hardened steel itself. Both gold and lead taken separately are, as we have before stated, malleable, but if an alloy of the two is produced by mixing but half a grain of lead to an ounce of gold a brittle compound is produced. Copper and tin singly are not very sonorous, but fused together into an alloy they produce bell-metal. The description of the physical properties of the metals, generally, will be resumed in my next communication.

Shrewsbury, May 24. EDWARD GLEDHILL.

MINING IN THE NORTH PART OF MONTGOMERYSHIRE.

SIR,—It is a well-known fact to many now that this county is very rich—perhaps, indeed, the wealthiest in Wales—for its mineral. This has been already proved to a great extent by so many new mines springing up, and several old ones, that were abandoned for 30 years more or less, having re-started, with the greatest prospect of success. As I have lately been called to inspect some of them, it may not be out of place to put the facts before the public, and I intend, if you will kindly favour me, to send the result of my observation as often as I can to the Journal.

CAE CONROY MINE is situated within an easy distance to Llanbrynmair, and in close proximity to a railway station. It belonged to Sir John Conroy, who has sold it for 50,000*l.* or 60,000*l.* This mine has for at least 20 years returned handsome profits, and during the last few years has paid a dividend of about 12,000*l.* per annum. From the present appearance of the mine it will greatly add to the amount of profit; indeed, as it is in contemplation to reform the old system of drawing the ore to surface, and so much orey ground being developed, the returns can be easily quadrupled. Mr. Morgans, I believe, is the manager, and he is fairly entitled to the credit of bringing it to its present state of prosperity.

North of Cae Conroy is the RHIW MWYN MINE (also within a short distance of the same railway station), which is now being re-started by a London firm. As I shall shortly have occasion to go there I shall defer making any remarks until then.

North-west of Cae Conroy Mine, and about a mile therefrom, is the CWM NANT-DU MINE, which until lately has not been working for a great number of years. Mr. Kindom many years ago made a rich harvest of its produce, the bulk of which was obtained near the surface. Having been called there lately with a mining gentleman, I naturally enough noticed the workings which have been done. I found that the deeper workings have not been carried on the main lode, but by all indications this part turned out a good-paying lead ore, especially eastwards, as it approaches the other lode, and forms a junction with it. Having probably been misguided by this, they have left the main lode untouched in the deeper workings. By extending the cross-cut 8 fms. further south the main lode will be intersected, and in driving eastwards a junction of lodes will be found. Seldom have I witnessed such a congenial and good-looking lode, very similar in its character to the productive and masterly lodes of Flintshire, without any of their elvan courses to disturb its wealth. In the 15 fm. level I observed a rich bunch of ore, composed entirely of carbonate of lime—so much so that I, being a stranger to the mine, could scarcely discern the ore, which was hidden under the coat of lime; when I took the pick and broke it down its produce quite astonished me—a finer lump of lead ore I never saw in any mine. As the workmen are now engaged in opening old workings more valuable orey ground is being developed, and I am confident, from a scrutinising inspection, that this mine before long will find its place in that golden column of your paper—the Dividend List. It surprises me how they abandoned it, and that within a few fathoms of the main lode. But it is a noted truth, that very frequently while some have laboured others come and reap the benefit. In a winze sunk on the lode in the bottom of another level I found the water heavy, but I noticed a good course of ore going down towards the deep cross-cut level south, which will shortly tap the water, and will give the proprietors a large quantity of ore to take away, and will also fully ventilate the bottom workings. I was lately told this mine has been sold for a few hundreds of pounds; but, bear in mind, my prediction is that in a few months hence it will prove a vast financial success to the purchasers. Other mines which come under my notice in my next. G. L.

May 23.

THE FUTURE PROSPECTS OF WHEAL BASSET.

SIR,—I have been much interested and also amused with the many vague reports and false prognostications which have been floating in the mining hemisphere of late concerning Wheal Basset; but this famous old mine, like a voyager's ship, has enjoyed many a bright and sunny day, as well as hours of apparent gloom and predicted adversity, which its prognosticators have magnified into the prelude of a tremendous and destructive storm. But I am happy, Sir, to inform the mining public through your widely-circulated Journal that this gallant old ship (Wheal Basset) has rode majestically and triumphantly over the predicted storm of its would-be prophets, and that it is now emerging forth rapidly into the bright and sunny sea of prosperity, destined to enrich the coffers of its spirited adventurers, which they so well deserve.

About three years ago the agents, in conjunction with the committee, plainly foresaw that there was a vast amount of reserve tin ground, of comparatively low produce, which could be taken away with great profit to the adventurers, provided that there were a stamps erected on a large scale, dressing-floors laid out on the most economical and improved system, and the tramway on the surface made of easy transit, so as to convey the tinstuff from the different shafts to the stamping-mill with the least possible expense; but to accomplish this important undertaking it would require the enormous sum of 15,000*l.* After due consideration the task was undertaken and prosecuted with the greatest ardour and diligence, which confers honour on all who were concerned in it. The result of this important undertaking is now plainly seen in the fact that the returns of mineral are rapidly increasing. Formerly the returns of tin were about 20 tons per month, but now they are increased to more than 30 tons per month, and realising over 80*l.* per ton. The copper, which a little while ago was about 100 tons per month, is now increased to more than 150 tons per month, so that the 15,000*l.* outlay will be soon cleared off the balance-sheet without one single call being made, and in five or six months it will again enter the list of dividend mines, and amply remunerate the adventurers for their praiseworthy conduct in such an important and noble undertaking.

This famous old mine is situated in one of the richest and most productive channels of ground in the county: it is about three-quarters of a mile in length, and nearly equal in width. There are upwards of a score of lodes traversing the mine, through easy and accessible ground, the nature of the locality being so productive of tin ore that carbonas are often met with even between the lodes, where rich deposits of tin are found. Several of the lodes have already begun to change their underlie, so that they are converging to one point, and when the junction of these lodes takes place there is every probability of meeting with a rich deposit of ore, which will greatly enhance the value of the mine, and become a precious boon to the adventurer. Keeping this object in view (the conjunction of the lodes), they have already commenced operations to sink the engine-shaft, which is to be prosecuted with the greatest vigour.

They are already working in this extensive mine between 80 and 90 pares of tributers, varying from 1s. 6d. to 13s. 4d. in 1*l.*; and also upwards of 40 pares of tutwork men, in addition to the 240 hands on the surface—so that the labour cost exceeds 1700*l.* per month, which bestows a great blessing on the neighbourhood. In conclusion, I would congratulate the adventurers on the hopeful prospect which lies before them. With good management, energetic prosecution of the mine, and a good standard for tin, I doubt not but Wheal Basset will be one of the most lasting and prosperous mines in the county.

May 21. A PRACTICAL MINER.

GENERAL MINING ASSOCIATION.

SIR,—Having seen in last Saturday's Journal a short account of my address to the shareholders of the General Mining Association, at their meeting on May 11, I trust you will afford me space in your next issue to explain what I intended to have said had I not been called to order by the Chairman.

That there is no doubt whatever of the value of the General Mining Association's property; that they have got coal fields practically inexhaustible; that their coals bring a higher price at Halifax than any other Nova Scotian coals, and the consumption in the Province of Nova Scotia alone ought, even in the present depressed state of the British American coal trade, to return a dividend to the shareholders if the mines were properly managed.

That the working expenses in England amount to 5893*l.* 4s. 4d. for last year—or nearly 1¼ per cent. on the gross capital of 559,300*l.*

That the office expenses in London are 1870*l.*, while the bulk of the work is, or ought to be, done in Nova Scotia.

The directors pay 300*l.* a year for an unfurnished office, and have furniture valued at 300*l.*, a secretary, and a staff of clerks.

That the prosperous Cunard Company do their London business in the company's offices, their door-plate quite overshadowing that of the General Mining Company, and that not one penny of rent appears in the accounts as having been levied by the directors. I trust that Messrs. Cunard will not now object to pay up for last and former years.

That there is a board of six directors, crediting themselves with large salaries when they are not returning any dividend.

The expenses in Nova Scotia, besides the working expenses, are 12,649*l.* 1s., or upwards of 2¼ per cent. on the gross capital, making in all upwards of 3½ per cent. on the aforesaid capital.

That three steamers, valued at 73257. 5s. 8d., are kept up at a heavy loss. If it is necessary that the company should provide tugs for the purpose of towing colliers in and out of harbour a private firm could easily be found to perform these duties for a small subsidy, and thus save the company the greater part of the expenses under this head.

That machinery, &c., was sent from England last year to the gross amount of 7005*l.* 11s. 6d., with a decreasing trade, and when the company has already spent such large sums on plant. Equally good machinery could have been purchased, if necessary, at Halifax cheaper.

That the sum of 1500*l.* a year is paid to Messrs. Cunard and Morrow as Halifax agents, besides a sum of 998*l.* 8s. 10d. which appears as bad debts in Nova Scotia, and commission on sales in the United States, 700*l.*

All these salient points I wished to lay before the shareholders, and to propose—

1.—That the London board should consist of three directors, to be paid by a small percentage on profit.

2.—That the secretary should be paid a sum (say, 300*l.* a year) to provide office, stationery, &c.

That there should be a sub-board at Halifax, consisting of Mr. Wm. Cunard, and two eminent Halifax merchants.

4.—And that a first-class mining engineer and financier should be sent out as agent to Halifax, whose sole duty should be to control expenditure and effect sales, with a small salary and commission on sales, under the supervision of the Halifax board.

Should these suggestions be carried out, I am confident that in twelve months the shares of the company would be again at par.

35, Dorset-square, May 24. CHAMPAGNE L'ESTRANGE, Captain R.A.

GENERAL MINING ASSOCIATION.

SIR,—My attention has been directed to the report contained in last week's Journal of the extraordinary general meeting of the General Mining Association, and from which incorrect inferences might be drawn. I have, therefore, applied to the secretary for a copy of the minutes of that meeting, by which you will observe that,—by your previous report, it would be inferred my views were not in accordance with the general opinion, and that I was in a hopeless minority, whereas it will be seen that my amendment was only lost by two votes; and if the votes of the directors, committee, and officials had been eliminated I should have had a considerable majority of independent proprietors in my favour. The proprietors will be doubtless pleased to learn that it has been since determined to print the report *in extenso*, and that it will be in their hands within a fortnight.—*Union Club, Trafalgar-square, S.W., May 26.* J. C. RUDING.

P.S.—My amendment having been lost, most of my supporters refrained from voting on Col. Weston's resolution.

[For remainder of Original Correspondence, see this day's Journal.]

IMPROVED GRINDING AND MIXING MILL.—A material improvement has just been effected by Messrs. John Fletcher and Sons, of the Eagle Foundry, Salford, in their patent grinding and mixing mill, which first came into use about 18 months ago. For the use of a mining company the firm have recently completed, with all their latest improvements, one of most uncommon size, which we have had an opportunity of seeing in operation. Its circular dish, which revolves smoothly and with the least possible friction upon conical rollers, is 12 ft in diameter, and the total weight of the machine is 30 tons. This includes two large crushing rollers, of 4 tons each, turning above the edges of the basin on their own axes, and these can be either raised or lowered at will, according to the pressure required. With a remarkably small degree of steam-power the machine can be kept in rapid motion, grinding stones, brick, coal, sand, or other hard substances to the finest powder when necessary. It seems adapted to mix mortar or pulverised minerals of any kind with equal efficiency, appliances being used to protect the bearings from getting clogged with adhesive grit. The novel feature that now more especially calls for notice is the "self-acting discharging apparatus" which has been attached to the machine. Hitherto the material ground in such mills has had to be emptied out of the trough with spades by labourers standing constantly by for the purpose. Thi

labour may, however, be now saved by Messrs. Fletcher's most recent addition to their useful and ingenious patent. The delivery slide, by means of which this can be accomplished, is made to rest on its centre across one side of the dish. When required, one end of this appliance can easily be lowered until it reaches the bed or floor of the revolving trough. There the mortar or crushed substances are gathered in and carried along the slide to wagons which may there be in waiting to carry it off. This is done by means of scrapers or scoops, which are run along the slide upon endless chains. Attached to the outer end of the discharging apparatus is fixed what is called a "doctor," a small metal plate, which thoroughly cleans each scraper as it rises.

FOREIGN MINING AND METALLURGY.

The metallurgical markets of France have shown rather more animation during the last few days; at the same time affairs have not regained their regular current. Paris seems to have much difficulty in deciding on passing orders into the Haute-Marne. At Lyons and the South, on the contrary, the demand is more sustained. Upon the whole, rolled merchants' iron remains in little demand, while machine and special iron enjoy a certain favour; for axles also there is a fair enquiry. It is announced that several establishments in the Champagne district have been obliged to reduce their production by reason of the drought which has prevailed. In the Moselle the favourable state of metallurgical industry, previously reported, continues; everywhere employment is abundant, and prices display much firmness. The canal lateral to the Moselle is now in operation as far as Pont-à-Mousson, and boat loads of coal, coke, and sand are now received by it at the Pont-à-Mousson works. The Pont-à-Mousson works are to deliver cast-iron columns for six furnaces, which are about to be constructed in the Luxembourg and in France, by MM. Metz, of Dommeldange, and the concessionnaires of a line from Longwy to Esch. There is a strike of working iron-founders at Paris; at a recent meeting they decided upon requiring that in future each man should be paid at the rate of 6d. per hour, and that work by the piece should be suppressed. It remains to be seen whether the employers will accept these conditions; probably they will not, but will prefer to send their work into the provinces, as they are now doing. The Bethune Mines Company is now paying its second dividend coupon for 1869, or 6s. per share. The Naval and Railway Blast-Furnaces, Forges, and Steel Works Company will pay, May 31, the balance of the dividend for 1868-9, or 6s. per share.

The Belgian coal trade does not show much change, except that the extraction has been somewhat reduced, in consequence of a number of men having left their places in collieries in order to go and work in brick-fields. Tenders have just been let for coal required for the Belgian State Railways. The contract prices secured for each description were sensibly higher than those obtained at the corresponding adjudication of 1869. In the case of some qualities the advance has been as much as 33 per cent., and the prices now obtained certainly bear striking testimony to the prosperous condition of Belgian coal mining industry. The Belgian iron trade has presented no very material change, the prosperity of the various works being still sustained. It must be remarked, however, that Prussia is making great efforts to reduce the quantities of railway *materiel* imported by her from abroad. Thus, powerful companies are being formed in Russia for the manufacture of rails and rolling stock, and as an essential condition in the granting of concessions for new lines imperial decrees stipulate that two-thirds of the rails and plant required shall be purchased from Russian works, only one-third being allowed to be imported from abroad. A report on the way and works of the Great Central Belgian Railway for 1869 states several points of interest. The report observes that it has been abundantly and decisively proved that iron rails cannot present sufficient resistance on those parts of the system where the gradients are sharp, and where the traffic is considerable. Bessemer steel rails have there been tried upon the Lodelinsart and Marcinelle incline, which is the sharpest upon the network. The steel rails laid down are found to resist much better the strain which they have to sustain, but it is feared that the polish which they acquire after having been in use for a certain time prejudicially affects the adhesion of the engines, and the action of the breaks. Experiments are being made this year in order to throw further light upon this important point. The management of the Great Central Belgian has come to the conclusion that Vignoles rails are the best devised for securing strength and resistance; at the same time it is observed that the cause of defects in rails is not to be found only in their shape, but also in the bad quality of the iron of which they are composed, or the imperfect manner in which they are rolled. Iron sleepers have been tried with satisfactory results upon the Great Central Belgian system. In 1869, 1538 new iron sleepers (Wautherin's patent) were laid down, and it was found that the portion of the way upon which these sleepers were in use required much less attention than that on which ordinary wooden sleepers were laid. No iron sleeper which had been laid was rejected in the course of 1869 as having become past further service. The North of Charlerof Collieries Company will pay, on June 1, a dividend of 16s. per share. The Sambre and Meuse Mines and Iron Works Company will pay, on July 1, a dividend for 1869 of 8s. per share. The Vieille Montagne Company is now paying 8s. per share, as the balance of the dividend for 1869.

The permanent way of the old network of the Northern of France Railway was renewed last year with new rails to the extent of one-eighteenth of the whole quantity of rails originally laid down, so that in eighteen years this portion of the system will be entirely renewed at the present rate of renewal. The administration also continues to introduce steel rails in those portions of the system over which the heaviest traffic passes. Some intesting remarks are made on the French coal supply question by M. Lacretelle in a paper published by the "Bulletin de la Société de l'Industrie Minerale." M. Lacretelle states that the consumption of Prussian coal is increasing in France more rapidly than that of English coal, while English coal appears to be gaining favour among the French rather more rapidly than Belgian. M. Lacretelle estimates that the amount of capital set fast to secure the production of each ton of coal raised in France is 1*l.* 4s. Taking an average of eleven years from 1855 to 1866 inclusive, M. Lacretelle states that the Anîche mines yielded an average profit of 3s. 2d. upon each ton of coal extracted. Of this 3s. 2d. per ton, 1s. 11d. per ton found its way into the pockets of the proprietors of the mines in the shape of dividends, and the balance was applied to first establishment expenses. Messrs. Bolckow, Vaughan, and Co., of Middlesborough, have obtained an order for rails, fish-plates, &c., for the Netherlands State Railways.

The Vieille-Montagne Zinc Mines and Foundries Company increased its production of zinc last year to 43,036 tons, as compared with 40,216 tons in 1868, 36,260 tons in 1867, 31,722 tons in 1866, and 30,592 tons in 1865. This great production, which amounts to 30 per cent. of the whole zinc production of Europe, would not have been attained merely with the minerals obtained from the company's own mines, but the directors supplied, to some extent, the consumption of the company's furnaces by means of purchases made abroad. The sales effected by the company on the various European and over-sea markets have followed the progress of the production, having amounted last year to 44,441 tons, of which 37,957 tons were zinc, properly so called. In the total of 37,957 tons, France alone figured for about half, Germany, Belgium, and Holland for one-fourth, and England, the United States, and other over-sea markets for the other fourth. The selling price of zinc last year was below that of 1868, but this element of loss was compensated for by a greater production and economies realised in the manufacture. Among the general causes which for several years past have tended to occasion a decline in the price of zinc, we should mention the great production of calamines in Sardinia, which has augmented, by more than 20,000 tons per annum, the general production of rough zinc in Europe during the last three years, and has disturbed the equilibrium which formerly existed between the production and consumption. The net profits realised by the company amounted last year to 124,846*l.*, and the dividend for 1869 is 16s. per share, absorbing 90,000*l.* This dividend shows some little improvement upon that paid for 1868, and the company's position seems to have improved generally during the last 12 months.

The New York papers are despondent about the condition of the shipbuilding interest in the United States. It is said that no better commentary upon the decay of American navigation interests can be had than is afforded in the fact that the Novelty Iron Works have sold off most of their machinery and tools; the Allaire Works are now occupied as a stable; the Etna Works have ceased to make marine steam-engines; the Fulton Iron Works are for sale; W. H. Webb's shipyard is to let; Henry Steer's yard is empty; the Continental Iron Works are almost deserted, and green grass is growing in nearly all the shipyards, which a few years ago were filled with workmen.

AUSTRALIAN GOLD MINING REPORTS.—We have been favoured by the Secretary for Mines, Mr. R. Brough Smyth, with the reports of the mining surveyors and registrars for the quarter ending December, 1869. The total quantity of gold got was—from alluviums, 232,255 ozs.; and from quartz, 162,631½ ozs.: together, 394,886½ ozs., raising the total for the year to 1,544,757½ ozs.; the quantity exported during the year was 1,340,838½ ozs. In the central division of the Ballarat mining district there was a falling off in the amount of gold obtained, but to show that no want of confidence exists in the locality Mr. Harrie Wood (the registrar) states that building is going on continuously, and more business has been done at the saw-mills than in any previous year. In the Buninyong division Mr. R. M. Harvey reports that there has been a stoppage during the quarter of several prospecting companies; there is still, however, considerable activity displayed on the Hiscock's line of reefs. The average yield per ton has been within a fraction of 4 dwts. In the Smythesdale division Mr. John Lynch reports that there has been a yield largely in excess of any produced in an equal interval of time for some years back. This improvement is entirely due to the prosperous condition of the main lead from Scarsdale to Piggoreet, along which, for a distance of about three miles, there is an unbroken succession of claims, every one of which is at present giving magnificent returns. In the Creswick division Mr. James Stevenson reports that the yield of alluvial gold is considerably greater than it has been for some time past, caused chiefly by the increased yield of the deep ground at the Red Streak, and the different sluicing parties, who have nearly all washed up. In the Gordon subdivision alluvial mining is dull, but quartz mining maintains its position. In the Beechworth division of the Beechworth district sluicing operations, which were almost at a standstill, have improved during the quarter, a copious fall of rain having taken place; the amount of gold obtained has, consequently, come up to the average for the corresponding quarters of previous years. The prospectors for the tin lode at the Pilot have, up to the present time, been unsuccessful in their search for the lode, but they have discovered that a considerable breadth of country in that neighbourhood contains stream tin, or black sand, in large quantities; it is thought that could water be obtained in sufficient quantities for sluicing purposes it would pay well. Another lease for tin mining has been applied for at the Clear Creek, near El Dorado. Here it is intended to sluice the bed of the creeks and such portions of the adjacent banks and flats as will be likely to pay. The black sand found here is of a superior quality, and the company applying for this ground intend to work it by means of Chinese labour, which can be obtained here at about one-half the price of European labour. Mr. Hunt, with one of his diamond machines, has been successful in finding two small diamonds at Sebastopol, together with a number of zircons, garnets, and other precious stones; but the market value of the whole is very trifling. This gentleman thinks that gems of greater value may yet be found at the Woolshed, and is making preparations for working a portion of the creek systematically. In the Big River subdivision Mr. A. B. Ainsworth reports the rumour of the discovery of an antimony reef which has reached him, and which he proposes to visit when somewhat opened up, and report upon. Nothing remarkable is reported from the other districts.

AUSTRALASIAN GOLD.—The imports of Australasian gold into the United Kingdom in the first three months of this year have been on a very considerable scale, having amounted to 1,727,854*l.*, as compared with 1,000,420*l.* in the corresponding period of 1869, and 934,909*l.* in the corresponding period of 1868. In the whole of 1869 the imports amounted to 7,892,757*l.*; this total shows a considerable improvement upon that of 1868, which was 6,989,594*l.*, and also upon that of 1867, which was 5,801,207*l.* In the preceding nine years the value of the Australasian gold received in the mother country had been as follows:—1858, 9,064,763*l.*; 1859, 8,624,566*l.*; 1860, 6,719,000*l.*; 1861, 6,331,225*l.*; 1862, 6,704,753*l.*; 1863, 5,995,368*l.*; 1864, 2,656,971*l.*; 1865, 5,051,170*l.*; 1866, 6,839,674*l.* The rally which the returns for 1869 and 1868 indicate in the production is due to the opening out of further gold fields in Queensland, South Australia, and New Zealand.

MINING IN SOUTH AUSTRALIA.—The news from the mines in the northern district of South Australia is as favourable as could be desired, so far as the evidence of the existence of mineral is concerned, but the development of the mines is rendered almost entirely impracticable in consequence of the absence of means of communication between the Far North and Port Augusta. Mr. Bonney appears to infer that the Nuccaleena and other mines of the same district are bunchy, but observes that there are several mines around the Yudanamutana which would appear to be of a permanent character. Whether the mines be bunchy or not, it is considered beyond question that they contain an abundance of mineral, and that were means provided of getting goods and materials to the mines and produce down, they would yield ample profits. The Blinman is supporting 1500 persons, and it is estimated that they could send down 2000 tons per month from the Yudanamutana; and as these are but two of many equally rich properties, there would be plenty of traffic to remunerate those who might find capital for the line. The principal question which appears worthy of discussion is whether it would be preferable to construct a railway or a tramway, many considering that the only water obtainable is better adapted for watering horses than for supplying locomotives.

THE QUICKSILVER MINES OF ALMADEN.—There are altogether nine *pisos* (levels) which strike at various depths and in different places the veins of quicksilver. The Spanish name for these veins is highly expressive, *cruadero*, the literal meaning of which is the "breeding place," or matrix. These veins are each called by the name of a saint; thus we have San Diego, San Julian, San Francisco, San Pedro, &c. The ordinary thickness of these saintly veins is from 4 to 5 fms., and in places where they cross each other it is still greater. In all there are six veins, which run from east to west within a very trifling distance one of the other, with one exception—that of San Diego, which deviates from the ordinary direction, and describes part of a large circle. The richness of the ore varies not a little in the different *cruaderos*, and the same mine exhibits often a remarkable diversity of yield in one *piso* compared with its yield in another. For instance, in the 7th *piso* (or level) the richness of the San Pedro *cruadero* (or vein) is 33·980 per cent. The same *cruadero* in the 8th *piso* gives a richness of 31·334 per cent., while in the 9th *piso* it has a richness of only 14·323 per cent. But San Nicholas is out of sight the richest of all the *cruaderos*. Its ore in places is nearly pure virgin quicksilver, that hardly needs to be smelted. In the 8th *piso* this saint has a richness of 83 per cent.; and in the 9th, 44½ per cent. We have no accurate data as to the regular annual yield of Almaden prior to the earlier years of the present century. During its two first decades the annual output was about 22,000 quintals of mercury, with a staff of 700 miners and 200 smelters. The *modus operandi* of the smelting was at once wasteful and pernicious to health. The ore yielded on the average from about 15 to 20 per cent., but there can be no doubt from the analysis that nearly one-half of the quicksilver was lost and dispersed in the air—to the great injury of the workmen's health—in consequence of the obsolete and inadequate apparatus of aludels employed in its sublimation, an apparatus which had remained without material change for the better since the days of the Moorish dominion. From an official document for the year 1866, we learn that the net produce of pure metal after smelting was 9550 metrical quintals, the money value being 19,775,000 escudos, or in round figures about 200,000*l.* There is now at Almaden a very prosperous school of mining. One of the chief evils in connection, not alone with these quicksilver mines, but with the mines of the whole Sierra Morena district, so rich in various minerals—want of facilities for transport—will be obviated by the new line of railway, which is rapidly approaching completion.

VALUE OF THE FOREIGN IRON TRADE.—The value of the steel and iron exported from the United Kingdom in the first three months of this year was computed at 4,240,458*l.*, or at the rate of 16,961,832*l.* per annum. It should be remarked, however, that the exports of iron to Russia are in great part suspended during the first three months of a year, so that the estimated total set down as likely to be attained in 1870 will, probably, be exceeded rather than otherwise. For the whole of 1869 the value of the iron and steel exported from these islands was 12,519,201*l.*, against 15,036,398*l.* in 1868, 15,050,391*l.* in 1867, 14,842,417*l.* in 1866, 13,471,359*l.* in 1865, 13,310,484*l.* in 1864, 13,150,936*l.* in 1863, 11,365,150*l.* in 1862, 10,326,646*l.* in 1861, and 12,154,997*l.* in 1860. The tendency of the yearly totals will be seen to be sensibly towards expansion.

The total of 19,519,201*l.* forming the aggregate for last year, was made up as follows:—Pig and puddled iron, 2,056,605*l.*; bar, angle, bolt, and rod iron, 2,684,071*l.*; railroad iron, 7,282,040*l.*; castings, 857,643*l.*; hoops, sheets, and boiler-plates, 2,253,600*l.*; wrought-iron of all sorts, 2,427,154*l.*; old iron for re-manufacture, 483,510*l.*; and unwrought steel, 1,038,800*l.*

THE AMOUNT OF GOLD IN THE WORLD.—The amount of gold in existence at the beginning of the Christian era is estimated to be 85,400,000*l.*; at the time of the discovery of America it had fallen to 11,400,000*l.*; it then gradually increased, and attained, in 1600, to 21,000,000*l.*; in 1700, to 70,000,000*l.*; in 1800, to 225,000,000*l.*; in 1843, to 400,000,000*l.*; in 1853 to 600,000,000*l.*; whilst the present amount is valued at 1,200,000,000*l.*, which, welded into one mass, could be contained in a cube of 26 feet. Of this amount, 800,000,000*l.* are estimated to be coin and bullion, 200,000*l.* in watches, and the rest in jewellery, plate, &c. A cubic inch of gold is worth (at 3*l.* 17s. 10½d. per ounce) 42*l.*; a cubic foot, 72,562*l.*; a cubic yard, 1,959,552*l.*

SEPARATING GOLD AND SILVER BY CHLORINATION.—The invention of Mr. F. B. MILLER consists in melting the bullion in a crucible, and passing into this through a pipe in the cover chlorine gas as long as chloride of silver is formed. This can then be poured off in a fused condition from the gold, which solidifies more quickly on cooling. The chloride of silver is reduced by plates of zinc, combined with slabs of chloride, into a galvanic arrangement. In 24 hours the chloride is completely reduced to spongy silver. No acid is required, and the zinc consumed is only 25 per cent. of the chloride reduced.

DISTILLING OILS FROM MINERALS.—The invention of Mr. G. BENNIE, of Kinning-park, Scotland, consists in introducing superheated steam by means of a peculiar appliance in such a way as, whilst acting on the vapour from the minerals by virtue of its heated condition, to also carry forward the vapour from the still or retort, and so serve as an efficient exhauster. The steam thus employed, and which may be heated to a temperature of 500° Fahr., or upwards, is introduced by means of a nozzle directed along the centre of the outlet-pipe from the still, or retort, and placed at or near the entrance from the still, or retort, into the pipe. The nozzle terminates in an expanding mouth, or cup, with which the bore of the pipe communicates by one or more, and by preference several, minute perforations, and this construction causes the steam to spread, so as to act more effectively on the vapour.

CARBONATE OF SODA.—The invention of Mr. C. F. CLAUS, of Middlesborough, consists in certain improvements in the manufacture of carbonate of soda, when such carbonate is made, by converting sulphate of soda into sulphide of sodium, and by decomposing solutions of sulphide of sodium by carbonic acid, and when this carbonic acid is obtained by the combustion of carbonaceous matter, such as furnace gases. The sulphide of sodium the inventor manufactures by heating the ordinary mixture of sulphate of soda, coal, coke, or other carbonaceous material by the aid of heat, generated by combustion of gaseous fuel, such as the waste gases from blast-furnaces, the gas-furnaces like, or similar to, Siemen's gas-furnace, or the gases from coke ovens, taking care that before, during, and after the combustion not more atmospheric air is admitted than is necessary to produce carbonic acid with the carbon in the said gases, so that after the heating of the sulphate and coke, or coal mixture, the products of combustion may serve as a source of carbonic acid, free from oxygen, to be used in the subsequent operations.

ELECTRICITY AS MOTIVE-POWER.—The invention of Mr. L. HICKES, of Liverpool-street, consists in providing and arranging one or more cylinders, chambers, or receptacles connected with batteries, by which means a current, or currents, of electricity is or are passed through each, or either, of them collectively, or respectively, at any desirable velocity, and the gases or atmospheric air therein decomposed, and vacuum produced by the action of each successive spark or sparks. Each cylinder is provided with a piston accurately fitted thereto, and connected by its rod either directly to a crank, cross-head, or other well-known means of communicating power to machinery generally; suitable valves are also introduced and applied for the free admission of air, and others for exhaust from the chamber of the water arising from the decomposition thereof.

The Royal School of Mines, Jermyn Street.

MR. WARINGTON SMYTH'S LECTURES.

[FROM NOTES BY OUR OWN REPORTER.]

LECTURE XLIII.—In my last lecture (said Mr. SMYTH) I put before you, briefly and hastily, a few of the facts connected with the removal of minerals underground, dealing almost entirely with the main roads, but looking at the means by which the broken material is removed and comes down to those main roads, sometimes by a declivity of considerable length, where the force of gravitation comes in to facilitate the application of horse-power, or to supersede it. I mentioned most of the improvements, short of the introduction of engine-power, which have been arrived at, and spoke of the use of railways underground as in vogue long before they were applied at the surface for the conveyance of merchandise and passengers. I pointed out that while at the surface a horse would, as a fair day's work, draw a load of 100 tons a mile, in the mine not more than 10 or 20 tons was drawn. One reason for this was the condition of the roads, the improvement of which so far differs from a mere matter of railway engineering in the fact that the continual upheaval of the floor creates a constant necessity for the relaying of the rails; and, in fact, an impossibility of maintaining the roads as they are easily done at the surface. If you have seen the admirable methods by which the movements are rendered smooth on the metropolitan railways, you might conceive it possible to keep the roads in a better state underground; but, in truth, the cases differ most materially. I have mentioned the cases in which levels are driven wide at first for the purpose of being employed as main roads, and kept open by pack-walling; but the expense of roads in a mine can only be described as perpetual, and often enormous, from the rising of the floors by the pressure from above on all sides, the falls of roof, and the cost of putting in and keeping up timber supports. Expenses of this kind are unavoidable and considerable, and it is not surprising, therefore, that every attempt has been made to reduce expenditure in those departments where economy is possible. Thus, the maintenance of a large number of horses in a mine was found to be a heavy burden, and the question whether it was feasible to introduce some mechanical agency in lieu of them became of importance. In most of the northern collieries fifty to eighty horses had to be kept, requiring extensive stabling underground, where (as in some places) they were not brought to the surface every night, and lowered every morning. For the most part, they were kept below, and many did not see daylight for twelve months at a time, and instances were not unfrequent where they were underground during their whole life-time. Then there must be an extensive farm attached, to supply them with food, or arrangements for a foreign supply of hay and oats, and down below a staff of persons to feed, and water, and clean the animals—to say nothing of veterinary attention. I can scarcely mention the intermediate steps which were taken, but most of the great northern collieries have been provided with engine-planes in all the main roads, upon which the wagons are driven by a stationary engine, placed at the bottom of the shafts. I do not know whether hydraulic power has been as yet much employed, but steam is used in various ways.

Canal conveyance was advocated by the great engineer, Smeaton, and others, as a great improvement over ordinary roads for heavy traffic, and no doubt it was so; but it was conceived that it might also prove of great advantage underground. In the last century, therefore, at several places levels were driven of extra size, puddled, and converted into canals. In Shropshire there is now a long level of this kind, which was designed to answer the double purpose of an adit and a means of conveyance, and which is called the "boat level." It was thought that, considering the large quantity of water which these levels often bring out, it would be a moderately cheap mode (where the geological conditions permitted) of bringing the valuable minerals to daylight. The boats are made flat and long, and the motive-power is obtained by means of a flat rope along the roof of the level, pulled at by a man who crouches in the bow of the boat. In some of these canals the mode of propulsion is not a little curious—for instance, in some places men called "leggers" lie on their backs on the top of the cargo, and push the boat along by the action of their feet upon the roof. In one or two of these ancient canals, as for instance, at Holywell, in Flintshire, visitors are floated into the interior of the mine, but they are often so close to the roof as to run a risk, if due care were not taken, to scrape their noses. At the celebrated Worsley Colliery, in South Lancashire, a water-level of this kind is carried in to a distance of several thousand yards; it is 8 ft. high, and 9 ft. wide. The roof is arched in places, and the thing is well done, but there is a difficulty of keeping up 4 or 5 ft. of water. In some of the Belgian mines, in the valley of Liége, in the Hartz mines, and at Clausthal they have these canals, but now-a-days they have often a rail running side by side with them. The whole value of such arrangements, it is obvious, must depend upon whether the use of an adit in this way will save the cost of raising the mineral to the top of the hill, and whether the conditions of the traffic will be best met at the point thus reached. The experience, however, of the last thirty years has established the rule that it is not worth while to go out of one's way to make such canals. Their decline was, no doubt, hastened by the exceeding slowness with which the mineral was moved, bearing no comparison with that of tramroads and railways. And so in the Hartz, where there is a canal 1000 fathoms in length; it would not now be tolerated, if the question of local convenience could be left out. We may, therefore, take it as a matter of certainty that very few water-levels of this kind are likely to be made in future.

Engines are sometimes placed at the surface, and the power is applied by means of a steam-pipe. In other cases a double engine is employed, with two cylinders resting on bed plates, with a heavy fly-wheel, placed near the bottom of one of the shafts, by means of which a drum is made to revolve and haul the trams of wagons by an endless chain. There has been considerable discussion as to which is the most economical mode of working. I can only say on this point that the method used in the North of England, in which the haulage is done by a simple rope, with a tail rope attached to the train, is very effective, and is worked with considerable advantage with long trains of carriages, and that from 25 to 50, and sometimes as many as 100, carriages are thus drawn at a rate varying from five or six to eight or nine miles an hour, and sometimes under circumstances which preclude the use of the ordinary railway. Where a water-wheel can be employed to turn the drum, this system of haulage is very economical. Elaborate calculations have been made as to the comparative cost per ton of different systems, but where the roads are tolerably straight and well kept, the endless chain seems likely to have the preference. In making an estimate of what the cost of underground carriage will be, it must be remembered that at the commencement of a colliery the distance over which the coal has to be removed is small compared with what it will be hereafter. An average, therefore, should be arrived at, and thus every item of expenditure can be tested, and should be watched with great care and jealousy by the mining engineer.

I may hear take the opportunity of saying a few words on the subject of mining engineers. Everybody now-a-days calls himself an engineer, from the man who plans a railway or makes a steam-engine, to the man who greases the wheels or stokes the fire, but the term "mining engineer" has a different meaning in districts. Thus, it is common in some places to call the general manager of a mine the mining engineer, although he may not be competent to take the direction of works of a purely engineering character. In the North of England such a person is called "a viewer," and he will generally be found to be a man of sufficient knowledge and experience to manage a colliery. In Cornwall and Devon a mining engineer is understood to be a man who has acquainted himself practically and theoretically with mechanics, and who is able to construct for himself, if need be, the engines he requires, but the man who directs the operations of the mine is called the captain. In our colonies, and in distant parts of the world, it is highly requisite for a mine manager to be able at least to direct the construction of machinery. Of course, in England, and for the most part in Europe, all kinds of machinery may be had to order, but the mining engineer should be able to judge of the quality of the material employed, and when we come to consider the raising of material in the shafts, it will be seen that he really ought to have a knowledge of mechanics, and of the application of mechanical power, whether derived from water or steam.

THE COAL MEASURES OF NOVA SCOTIA AND ENGLAND.

ON THE STRUCTURE AND AFFINITIES OF SIGILLARIA, CALAMITES, AND CALAMODENDRON.

By J. W. DAWSON, LL.D., F.R.S., F.G.S., Principal and Vice-Chancellor of M'Gill University, Montreal.

The object of this paper* was to illustrate the structure and affinities of the genera above named, more especially with reference to the author's previous papers on the "Structures in Coal" and the "Conditions of Accumulation of Coal," and to furnish new facts and conclusions as to the affinities of these plants.

With reference to Sigillaria, a remarkably perfect specimen of the axis of a plant of this genus, from the coal field of Nova Scotia, was described as having a transversely laminated pith of the Sternbergia type, a cylinder of woody tissue, scalariform internally and reticulated or disciferous externally, the tissues much resembling those of Cycads. Medullary rays were apparent in this cylinder; and it was traversed by obliquely radiating bundles of scalariform vessels or fibres proceeding to the leaves. Other specimens were adduced to show that the species having this kind of axis had a thick outer bark of elongated or prosenchymatous cells. The author stated that Prof. Williamson had enabled him to examine stems found in the Lancashire coal field, of the type of Binney's Sigillaria vascularis, which differed in some important points of structure from his specimens; and that another specimen, externally marked like Sigillaria, had been shown by Mr. Carruthers to be more akin to Lepidodendron in structure. These specimens, as well as the Sigillaria elegans illustrated by Brongniart, probably represented other types of Sigillarioid trees, and it is not improbable that the genus Sigillaria, as usually understood, really includes several distinct generic forms. The author had recognised six generic forms in a previous paper, and in his "Acadian Geology;" but the type described in the present paper was that which appeared to predominate in the fossil Sigillarian forests of Nova Scotia, and also in the mineral charcoal of the coal beds. This was illustrated by descriptions of structures occurring in erect and prostrate Sigillariæ, on the surface of Sternbergia-casts, and in the coal itself.

The erect Calamites of the coal formation of Nova Scotia illustrate in a remarkable manner the exterior surface of the stems of these plants, their foliage, their rhizomata, their roots, and their habit of growth. Their affinities were evidently with Equisetaceæ, as Brongniart and others had maintained, and as Carruthers and Schimper had recently illustrated. The internal structure of these plants, as shown by some specimens collected by Mr. Butterworth, of Manchester, and soon to be published by Prof. Williamson, showed that the stems were more advanced in structure than those of modern Equisets, and enabled the author to explain the various appearances presented by these plants, when the external surface is preserved wholly or in part, and when a cast of the internal cavity alone remains. It was further shown that the leaves of the ordinary calamites are linear, angular, and transversely wrinkled, and different from those of the Asterophyllites, properly so called, though some species, as A. comosus, Lindley, are leaves of calamites.

The Calamodendra, as described by Cotta, Binney, and others, and further

* Read at the Geological Society of London, on May 11.

illustrated by specimens from Nova Scotia, and by several interesting and undescribed forms in the collection of Prof. Williamson, are similar in general plan of structure to the Calamites, but much more woody plants; and, if allied to Equisetaceæ, are greatly more advanced in the structure of the stem than the modern representatives of that order. Specimens in the collection of Prof. Williamson show forms intermediate between Calamites and Calamodendron, so that possibly both may be included in one family; but much further information on this subject is required. The tissues of the higher Calamodendra are similar to those of Gymnospermous plants. The wood or vascular matter of the thin-walled Calamites consists of multiporous cells or vessels, in such species as have been examined.

In conclusion, a table was exhibited showing the affinities of Sigillariæ on the other hand, through Clathraria and Syringodendron with Lycopodiaceæ; and, on the other hand, through Calamodendron with Equisetaceæ; while in the other direction they presented links of connection with Cycads and Conifers.

Mr. CARRUTHERS expressed his thanks for the amount of information given by Mr. Dawson, but was inclined to take a somewhat different view on some of the points mentioned. Some time ago he had, in a paper read to the Society, deduced from the internal structure of Stigmaria, the root of Sigillaria, but the latter was a true cryptogamous plant. He had since met with confirmatory evidence in a specimen of a fluted and ribbed Sigillaria, showing the internal structure of Stigmaria. Mr. Baily, in Devonion strata in Ireland, had found the root, stem, branches, leaves, and fruit of a plant which could, with certainty, be correlated. The root was a Stigmaria, the stem a fluted Sigillaria, the branches and leaves like those of Lepidodendron, and the fruit was a cryptogam, allied to Lepidodrendron. With regard to the American specimens cited by the author, he would not speak with certainty; but he might suggest a different interpretation. The axis was probably foreign to the Sigillaria in which it was found, and was a true coniferous stem, composed of pith, medullary sheath, and wood with medullary rays, and vascular bundles passing to the leaves. Plants growing in the interior of decayed sigillarian stems had been mistaken for organic piths, though they belonged to two or three genera. Dr. Dawson's estimate of Calamites and allied genera essentially agreed with those which he held.

Mr. DAWSON thought that the views of Mr. Carruthers and his own might possibly be reconciled, and was not prepared to admit that the plant discovered by Mr. Bailey was a true Sigillaria. It belonged, moreover, to the Devonian period, and not to the Carboniferous. He quite agreed with Mr. Carruthers in regarding the stems as closely allied with gymnosperms. He insisted on the layer at the base of the interior of the trunks of the erect Sigillariæ affording evidence of the interior structure of the plant, inasmuch as it consisted of the compressed and decayed inner tissues of the tree. It was curious that similar specimens had not been found in England; but the structures of these plants certainly occur in the English coal, which, like that of Nova Scotia, rests on Stigmaria under-clays; and there were other instances of trees being common in the coal measures of Nova Scotia which were extremely rare in England; and the same discrepancies were found between different American coal fields.

ON THE RELATIVE SAFETY OF DIFFERENT MODES OF WORKING COAL.

BY MR. GEORGE FOWLER.*

It was maintained by the author that whilst there was no possibility of freeing the workmen engaged in coal mining from accident, there was reason to hope for a considerable diminution in the proportion of those killed to the number employed. It was the purport of this communication to show that the mode of getting coal had considerable effect on the safety of the workmen. The accidents incidental to mining were classified by Her Majesty's Inspectors of Coal Mines under five heads, as arising from explosions, from falls of roof or of coal, in shafts, from miscellaneous causes underground, and on the surface. It appeared that in the years 1866, 1867, and 1868, out of a total of 3686 casualties, 1091 were the result of explosions, and 1255 of falls, or, respectively, 29 per cent. and 34 per cent. of the whole; the remaining 37 per cent. being attributable to other causes, which were not influenced by the mode of working. The different methods of getting coal, which were described in detail, were the practical application of two distinct principles. One idea was to remove the coal at two operations, and this was practised in the bord and pillar work of the North of England, in the bank work of Yorkshire, and in the stall work of South Wales. The other idea was to remove the whole of the mineral at one operation, as exemplified in the long wall system of the Midland Counties. In the latter case, as the faces advanced, packwalls of roof rock, or bind, were built at regular intervals, and, whenever a sufficient width of opening was obtained, the roof settled down, with or without fracture, upon these packs. Accidents by falls might fairly be brought to the test of figures, for, although the roofs of various seams might differ much, the averages of large districts were likely to be uniform. Of a gross tonnage of 198,636,043 tons obtained by pillar work in 1866, 1867, and 1868, the casualties by falls were 814, or 231,739 tons of coal for each life. Of a gross tonnage of 22,899,000 tons extracted by the long wall plan the casualties were 75, or one life for every 305,320 tons. If the latter ratio existed in pillar work the casualties would have been reduced from 814 to 614, or a saving of 200 lives. In these calculations certain coal fields, which yielded about three-tenths of the produce of the whole kingdom, had been excluded; as in North Staffordshire, Cheshire, and Shropshire both modes of working coal were adopted, and the same was the case in Scotland. The mortality from falls was greatest in South Staffordshire, where the lofty cavernous openings killed off one man for every 214,517 tons of coal raised, or an excess over the ratio of 35 per annum. There, too, the coal was obtained by both methods, but the greatest number of accidents took place in the Thick seam, which was worked in pillars. The greater safety of long wall mines from falls was owing to the narrow width of the working places, to the constant change to a new roof, so that there was not time for atmospheric action, which greatly weakened the roofs of many mines, and to the small extent of open mines, which permitted a more thorough examination. It might be thought that in long wall work the constant settlement, or bending down, of the roof would be attended with danger, but practically that was not the case. If a fracture occurred, it was not by the running down of a number of loose fragments, but a general settlement took place gradually, accompanied with so much noise that warning was given, when the workmen retired. The excessive mortality of some pillar districts was owing to the weak, under-sized pillars, which were crushed and sank into the floor, and induced a weak, jointy state of the roof. The goodness of a roof as often depended upon the way in which it was managed as upon the character of the material of which it was composed.

With respect to explosions, the author contended that the mode of getting coal had more influence on this question than was usually allowed; and whilst fans, safety-lamps, the absence of gunpowder, and all sorts of precautionary expedients were proposed, and were more or less adopted, the effect of the mode of working, perhaps the most important of all, had been lost sight of. It might be safely laid down that that mode of working was the safest from explosions which admitted of the most perfect ventilation, which was the least subject to a local failure of ventilation, in which the discharge of gas was best regulated, in which large accumulations of gas were prevented, and in which the superintendence of the workmen could be most thorough. In an unbroken coal field the free hydrogen might be assumed to be distributed evenly over small areas, and each ton of coal would have a certain proportion diffused through it. If this were liberated only in the coal actually cut, and when it was cut, the amount of ventilation could be exactly regulated to the production of the mine; and the mode of work, so long as ventilation was possible at all, would be immaterial. The fire-damp lying in coal seams possessed considerable mobility amongst the particles of coal, and, as it was often at a pressure in excess of the atmosphere, it travelled through the coal for some distance towards a point of discharge. The rapidity with which a given area was so drained, no doubt, varied in some proportion to the difference between the initial pressure of the gas and that of the atmosphere, and the amount of resistance which the gas met in permeating the coal. It also varied according as the openings were bordways or endways of the seam. In all probability it was three or four times the greatest on the end of the coal, as the cleavage planes were, to a certain extent, channels for the passage of the gas. Thus, in a headway on the end of the coal, the discharge of gas was most abundant at the back of the heading; while in bordways it was most perceptible at the sides of the heading, and in such a heading a large part of the gas would probably be let off for some yards on each side. When the excess of pressure was relieved the discharge might be supposed to vary with the changes in the barometrical pressure. It was suggested that experiments should be made in different localities, to ascertain (1) the quantity of gas given off per square yard of freshly cut surface, (2) to what extent this varied on the face or end, (3) in what ratio this discharge diminished with time of exposure, (4) to what extent barometrical changes affected the discharge of the gas, and (5) by what amount the pressure of gas increased, as measured from the exposed surface inwards to the solid seam. It was believed such experiments would show that from 50 per cent. to 75 per cent. of the gas contained in the coal lying 10, 20, and 30 yards on each side of a bordways heading was liberated when, and after, this was driven.

As the free hydrogen gas came not only from the hewn coal, but also from the solid seam, it was important that the surface exposed to the air should be as small as possible. It was argued that every mode of pillar work liberated three, five, or ten times the amount of gas per ton hewn in the solid than was liberated by a sytem of long wall work. If, therefore, the diluting power of the air-current was the same in both cases, three, five, or ten times more would be necessary in pillar mines than in long wall mines. In a mine under the author's charge this excessive discharge of gas in pillar roads was very noticeable. Long after a headway was driven the gas oozed out of the sides of the headway, and might be heard at a considerable distance. In the long wall faces this was not perceptible, as the gas given off there was that due merely to the coal hewn.

Again, in pillar mines from six to twenty times as much surface of coal was exposed as in long wall mines, and, therefore, such mines were from six to twenty times more subject to the effect of changes in the atmospherical pressure.

On inspecting the maps of mines worked by different pillar methods, and comparing them with the diagram showing a like extraction of coal by long wall, it was clear how large a proportion the gas discharged in the former must bear to that in the latter. It was frequently argued that this gas drainage was desirable, but it was submitted that before such a course could be with propriety recommended it was necessary to show that the ventilating current would be proportional to the discharge.

The ease with which a mine could be ventilated, and the freedom from local derangement, would depend much upon the cubic contents of open mine, upon the freedom from stoppings, doors, &c., and upon the general simplicity of the arrangements. For a like extraction of coal the cubic contents of pillar mines were from 10 to 20 times the amount of properly designed long wall mines, and the drawings showed clearly the relative simplicity of each. In every pillar mine the workings were driven in advance of the ventilating channels, and constant brattices were essential. It would be seen, by examining the reports, how numerous were the accidents from defective brattices.

In South Wales the working places were driven into the solid coal, and when finished had no channel left for a steady through current, and thus the chance of their harbouring fire-damp was very great. In the North of England there were none of these dumb points, but the cubic contents of bords, in which there was no sensible current, was often very large. Whatever might be the difference of opinion with regard to barometrical changes in mines, it was reasonable to suppose that they would exert the least influence where the surface of coal which might exude gas was the least. The proportion which the surface exposed in pillar mines bore to that in long wall mines was from 10-20 to 1. The goaf of a long wall mine became approximately solid as the coal was extracted over large areas, and thus permitted of a general settlement. In pillar mines the tendency was towards the formation of many small goaves, where there could be no surface settlement. These goaves thus became so many gas holders. The long wall mode of work also admitted of the nearest approximation to goaf ventilation. The only open parts were the edges, and as these were cut through with roads a constant current could be maintained along them. It was possible, in a properly laid out long wall mine, to keep the goaf clear of gas as far back as it was open. In pillar workings there was no possibility of sending air into the goaf, and it thus became charged with gas. It was, therefore, submitted that the safety of mining operations might be increased by the extension of long wall working. It was satisfactory to be able to add that on economical grounds it was daily gaining in favour, and that simplicity, compactness, small cubic contents of open mine, small exposure of coal surface, regular gas discharge, and thorough ventilation, could be best attained in long wall mines.

* Read at the Institution of Civil Engineers on May 24.

ON COAL MINING IN DEEP WORKINGS.

BY MR. EMERSON BAINBRIDGE, STUDENT INST. C.E.*

In this communication the principal conclusions arrived at were:—

Judging from the statistics of the past few years, the production of the British coal fields could not be considered to increase annually in a constantly increasing ratio, as had been surmised, but might be estimated at an average output of 105 millions of tons yearly. Estimating the coal remaining in the British Islands to a depth of 4000 feet to be 37,300 millions of tons, this quantity of coal would supply the annual demand of 105 millions for 355 years; and, taking the limit to deep mining to be a depth from the surface of 7000 feet, the further quantity of coal estimated to be workable to this depth was 57,222 millions of tons, which would extend the supply for a further period of 535 years. The chief localities in the British Islands where coal would probably be found at greater depths than had hitherto been reached were (1) the West Coast of Ayrshire, (2) the West of Lancashire, (3) the East of Yorkshire, Derbyshire, Nottinghamshire, and Staffordshire, and (4) below the seams worked at present in the South Wales basin.

Deep mining had been carried on much more extensively in Belgium than in England, there being only twelve pits of a greater depth than 1500 ft. in the latter country, as compared with 68 in the former. The deepest coal mine in the world was probably that of Simon Lambert, in Belgium, which had attained the great depth of 3489 ft. The deepest coal mine in England was the Rosebridge Colliery, in Lancashire, which had reached a depth of 2418 ft., the temperature of the coal at that depth being 93·5°. The distance from the surface of the ground to the stratum of invariable temperature might be taken at 60 ft., and the constant temperature at that depth at 50°. The accounts published between 1809 and 1840 of several hundred experiments relating to the temperature of coal and metalliferous mines showed the increase of temperature to vary from 1° for every 45 ft. to 1° for every 69 ft.; the distance from the surface at which the experiments were made varying from 100 to 1700 ft. The results of more recent experiments in England and on the Continent were irregular, and showed an increase varying from 1° for every 41 ft. to 78 ft., the distances from the surface being from 700 to 2600 ft. On comparing the experiments made at the two deepest English coal mines—Rosebridge and Dukinfield—it was found that the increase of temperature due to depth was much less rapid at the latter colliery than at the former; and this difference was assumed in a paper read recently by Mr. Hull, to be due to an amount of heat being lost at Dukenfield, owing to the heavy inclination of the strata, which was about 1 in 3, whilst at Rosebridge the coal seam was nearly level. The relation of the position of the bottom of a mine to a sea level influenced the temperature, as shown in accompanying tables. In one table the average increase of the temperature of three mines of a high elevation was 1° for every 71·6 ft., whilst the increase for three mines at some distance below the level of the sea was 1° for every 62·3 ft.

The experiments relating to the underground temperature of the air at the Rosebridge Colliery showed an increase in the temperature of the air in passing from the downcast to the upcast shaft of from 55° to 63°; the air passing through workings the temperature of which was 78°, and the normal temperature of the coal being 93·5°. The experiments at Monkwearmouth showed the effect of a large volume of air in preventing a rise in temperature. At a distance of 1800 yards from the shaft, with 80,000 cubic feet of air passing per minute, the temperature was 55°, whilst at a distance of 2600 yards from the shaft, with 10,000 cubic feet of air circulating per minute, the temperature was found to be 67°.

The normal temperature of the coal might be estimated, from the results of experiments at Seaham Colliery, to exist in a main air channel, which had been exposed to the air for some time, at a distance of about 13 ft. from the surface of the mineral. The highest temperature at which coal mines were worked was probably in Staffordshire and at the Monkwearmouth Colliery, where the temperatures varied from 80° to 85°. At the Clifford Tin Mine, in Cornwall, the temperature was 120°, in which the miners could only work for 25 minutes consecutively, this high temperature being due to the heat of the water issuing from the rock. It would appear from the contradictory results of the experiments relating to the temperature of different minerals that no rule could be laid down. It was probable, however, that the temperature of mines was affected to some extent by the varying conducting power of different minerals.

In regard to the increase of temperature with the distance from the surface, a careful comparison of all the experiments quoted, and especially of those taken at a greater depth than 2000 ft., led to the conclusion that, as far as could be judged from the experiments already made, the increase of temperature would be 1° for every 55 ft. in depth, from the stratum of invariable temperature. The data afforded by the experiments were so irregular that no law could be established as to the ratio of increased temperature augmenting or decreasing with increased distance from the surface, though the experiments at South Hetton and at Mouillelonge, as recorded in the paper, appeared to indicate that the rise in temperature became more rapid as the distance from the surface increased. Assuming the rate of increase in temperature to be as previously estimated, the normal temperature of a mine 7000 ft. deep would be 176°.

Of the three modes by which heat was lost by one substance, and absorbed by another—radiation, conduction, and convection—the only influence likely to come into action in a well-ventilated mine of the depth stated would be that of convection. From the observations recorded, it would seem that as a rule when the temperature of the surface exceeded 66° the temperature at the bottom of the pit was less than at the top, but when less than 66° at the top of the pit an increased temperature was found at the bottom. The increase in the temperature, due to the increased density of the air in deep mines, was estimated at 1° for every 800 ft., making the mean temperature of the pit 7000 ft. deep above 56°.

The effect of the heat emitted by workmen, candles, explosion of gunpowder, &c., was estimated not to have any appreciable influence on the temperature of the air circulating in the mine. The experiments at Seaham showed the temperature of the return air to be 0·5° *lower* when the mine was in full operation than when the pit was off work, and when no lamps, workmen, &c., were in the workings. An unexplained cause of high temperature had been observed at several collieries, but more particularly at Monkwearmouth, where the temperature of the air on one occasion was found to be 95°, or upwards of 16° higher than the normal temperature of the mineral. The question as to the effect of pressure upon deep workings was unquestionably of great importance, and necessarily very speculative. The mode of working coal, suggested for a depth of 7000 ft., was arranged as far as possible in accordance with the principle that the coal should be removed so as to present long lines of fracture, and should be so worked as to cause the superincumbent weight of the strata overlying the goaf, or space where the coal was worked out, to have all its pressure upon such goaf, and a minimum pressure upon the coal. The increase in temperature in an underground air channel appeared to average about 1·5° for every 500 yards.

The question of ventilating a mine 7000 ft. deep to an extent sufficient to absorb the heat emitted by strata having a normal assumed temperature of 176° was one of the most important in the enquiry, and the general results arrived at might thus be enumerated:—1. The temperature of the air was estimated to increase from 59° at the bottom of the downcast pit to 65° at the point where it reached the workings.—2. The length of time which would be occupied in cooling the main air-way to such an extent that the sides of the road would have an average temperature of 62°, and the normal temperature would be found as far as 12 ft. from the surface of the mineral, was calculated to be 40 days.—3. The total number of units of heat emitted by the strata per minute was found by calculation to be 45,320.—4. The volume of air introduced at the temperature of 65°, and assumed to leave the workings at a temperature of 89°, necessary to carry away this number of units of heat, was calculated to be 73,000 cubic feet per minute.—5. Then, taking the total quantity of air necessary for the ventilation of the pit to be 110,000 cubic feet per minute, the power required to produce this quantity would be 141 H.P., which represented a average temperature in the upcast pit of 90°, for the attainment of which mean temperature a temperature of 141° was required at the bottom of the upcast pit.—6. The quantity of fuel necessary to raise the temperature of the return air from 90° to 141° was found to be 14·04 tons every 24 hours.

The laws upon which the amount of power necessary to produce a certain quantity of air under every condition was stated to be as follows:—The pressure per unit of sectional area of an air-way required to overcome the friction of the air varied directly as the length of the air channel, as the length of the perimeter, and as the square of the velocity of the air, and inversely as the sectional area of the air-way. The action of these laws was demonstrated in the several examples given, where it is shown that the power required to overcome the resistances varied as the cube of the velocity. In drawing a comparison between furnace and mechanical ventilation, it is calculated that at a depth of about 2500 ft. the two modes of ventilating were equal, while below this depth the furnace became the more effective power.

In regard to the raising of coal, the probable limit from which it might be drawn at one lift was estimated to be about 900 yards, below which depth one winding-engine at the surface and one in the shaft would be required. An increase in the cost of sinking to great depths, and in the cost of producing the coal, must necessarily be expected; but since the selling price of coal would, to a great extent, be adjusted accordingly, this could scarcely be considered as a difficulty of much consequence.

The employment of machinery in place of manual labour would, probably, be found very beneficial in cutting and breaking down coal in deep mines having a high temperature. Some of the coal-cutting machines now at work were driven by compressed air, and the sudden decrease in temperature which compressed air underwent on exhaustion had been thought likely to be of use in reducing the temperature of a mine. In reality, however, scarcely any reduction could be anticipated, since the quantity of air exhausted bore so small a proportion to an ordinary current of air, that the effect on the temperature was only to be observed locally, and to a very slight degree. Of other modes which had been proposed for facilitating the working of coal at great depths, neither that of casing the airways with non-conducting substances, nor the employment of the electric light, nor the use of cold water and ice, could be anticipated to have any effect worthy of note. The hygrometrical experiments recorded showed that the dryness of the air was considerably increased with increased depth, especially in the return air-courses; and though this usually caused a high temperature to be borne more conveniently, it could not, in the case of the heavy labour required in working coal, be calculated to confer any benefit.

Finally, it might be stated that the question of working coal at greater depths than had hitherto been attained could not be considered to be one which presented difficulties of any importance, nor was it one which required immediate consideration.

The author had endeavoured to prove that coal could be worked at a depth of 7000 feet, but it would probably be centuries before such a sinking would actually be required, and improvements in the various descriptions of mining machinery, especially such as were intended to facilitate the getting of coal, would possibly before long render mining to such a depth as practicable as the workings of deep mines of the present day. Commercially, as had been observed, the question would adjust itself to the requirements and expenditure of the times.

THE INSTITUTION OF CIVIL ENGINEERS.—At the last business meeting of this society for the session 1869-70, which was held on Tuesday, Mr. Charles B. Vignoles, F.R.S., President, in the chair, twenty-four candidates were duly elected, including seven *Members:* Mr. John Bower, Dublin; Mr. George Buchanan, Westminster; Mr. William Janvrin Du Port, late chief engineer of the Victoria Dock Company, Singapore; Mr. James Barry Farrell, Wexford; Mr. John Hill, Ennis; Mr. Carl Siemens, Westminster; and Mr. R. Tyndall, executive engineer P.W.D., India. Seventeen gentlemen were elected *Associates:* Mr. John Collier, Salters' Hall; Mr. Frederick Colyer, Leman-street; Mr. Joseph Samuel Forbes, engineer of the Trent and Mersey Navigation, Shelton: Mr. John Lawton Haddan, engineer-in-chief for Syria and the Lebanon; Mr. Charles Hall, engineering staff of the P. and O. Steam Navigation Company, Southampton; Mr. Arthur Samuel Hamand, Birmingham; Mr. Alfred Chalmers Lawford, executive engineer, P.W.D., India; Mr. Matthie Charles Mackinnon, Adelphi; Mr. Edward Manisty, Dundalk and Greenore Railway Pier and Harbour Works; Mr. Charles Robert Manners, Inverness; Mr. Angus Nicolson, Skipton Castle, Yorkshire; Mr. Robert Pitt, Newark Foundry, Bath; Mr. John Rotheroe, King William-street; Mr. Charles Edward Shepherd, Lieut. B.S.C., executive engineer, P.W.D., India; Mr. William Stroudley, locomotive superintendent of the London, Brighton, and South Coast Railway; Mr. Henry Hay Wake, Sunderland; and Mr. Richard Harris Williams, St. Austell. A report was brought up from the Council, stating that, under the provisions of Section 4 of the Bye-Laws, the following candidates had been admitted *Students* of the Institution since the last announcement:—Messrs. H. E. R. Hoggar, F. J. Odling, and H. J. Pratt. During the session just concluded there have been added to the Register of the Institution 42 *Members* and 114 *Associates*, while the Council have admitted 56 *Students*. The numbers of the several classes now on the books are 16 Honorary Members, 703 Members, 1002 Associates, and 178 Students, or a total of 1899 of all classes, as against 1758 at the same date last year, or an increase in the interval of upwards of 8 per cent.

FOREIGN MINES.

DON PEDRO NORTH DEL REY (Gold).—Telegram from Lisbon—Weighed to April 30, 6797 oits.; estimated produce for April, 8727 oits.

NEVADA (Land and Mining).—J. J. Dunne, May 2: I have taken steps to make use of the water for supplying the citizens of Reno, and to-day perfected an arrangement by which parties are to put down the pipes, and to bear all the expense, and pay to us one-half of the gross receipts; this agreement being for the term of five years, and water works to be in running order within 90 days. A special election is called for July 14, to decide on making Reno the county town; I have no doubt of such being the result, and this will bring our building lots into market. Bullion receipts for the last week of April to date $5670·42,100.—[The total gross bullion receipts reported for the quarter ended April 30 amount to $31,602, the mill having been stopped about six weeks to enlarge the tail-race.]

ALMADA AND TIRITO (Silver).—Fitzhugh, New York, telegrams—"Ciemes reports (April 18) stamps running full time, and preparing for additional five heads."

BRAGANZA (Gold).—The directors have received the following telegram:—"Intersected another lode 7 feet thick. Gold contents, according to sample, 3 ozs. per ton."

ECLIPSE (Gold).—Capt. Barratt, April 25: I took real possession of the Eclipse gold mining property, in the name of the Eclipse Gold Mining Company (Limited), on Monday, the 18th inst., and our staff commenced at once to prepare adobees to repair and build houses near the mill site; some of the miners, however, have been at the mine. The necessary works will now be carried on without let or hindrance. I have given an order for some lumber (timber) for roofing the houses and for making a bridge across the Owen's river, near our reduction works. The most necessary work at present will be the erection of houses and repairing the incline (track) from the mouth of the mine to the base of the mountain, which will take us a little time, as some of the runners and iron have been stolen, and our European staff will attend to that, as well as prepare the site for the mill or stamps. The mine itself may not have much done to it for some time, and we need not repine at that, because we have any amount of first-class solid quarts or ore discovered, and can be easily taken away at once when required, without any trouble. We shall not be put to any cost developing the mine, as that is already done; and ore can be raised in any quantity, which shows that very little capital will be required in the development, which is a very large item of cost or expense in most other mines. I went to the mine accompanied by Capt. Endy, and we took out exceedingly good specimens of gold ore, showing free gold, and I am more than ever before impressed that we have a very rich mine. It must be remembered that the company's mining property (the Eclipse) is 8100 ft. long, more than four times the extent of ordinary gold mining claims in California, and not leased for 20 or 30 years, like many other mines. The Eclipse Gold Mining Company have a perpetual freehold right of possession. You may be sure that all the necessary works will be carried on with the greatest ability and skill, and due care to economy.

EXCHEQUER.—Capt. Chalmers, April 25: During the week ending Saturday, April 23, the enlargement of the air-shaft was completed—26 feet having been accomplished. The winze is down 53 ft., and we shall commence to drift north, preparatory to stoping out the ledge to-day.

CAPE (Copper).—The directors have despatches per Cambrian. The various operations were proceeding satisfactorily. Ookiep return of ore is short in consequence of hauling being temporarily stopped to allow a boiler to be cleaned. The ground for tramway is formed to 31 miles. The men will be put to work to continue the laying of rails, and the engineer anticipates rapid progress. Returns for March (net dry tons)—Yield: Ookiep, 385 tons; Spectakel, 91 tons. Total transport to the coast for the month, 320 tons. Bills of lading, 615 tons per Antonio Vinent, and 36 tons per steamer.

PESTARENA UNITED (Gold).—T. Roberts, Jas. Mitchell, May 16: Val Toppa: In No. 2 level, in a cross-cut that we commenced at the beginning of this month, to drive east from the end of the level north, on the flat lode, we reached in 2 metres driving the so-called new lode; we have not cut through the whole width as yet; we shall make a trial of the ore this week. In the second cross-cut, driving west in No. 3 level, we have traversed a branch of auriferous quartz that gave by a trial 5 dwts. of gold per ton; we are continuing the driving of this cross-cut in a beautiful stratum of ground, and expect shortly to reach a lode of more importance. The stopes in the back of Nos. 2 and 3 levels are looking well.—Pestarena: The 2¼ fm. level ends, north and south from Aquavite shaft, are both promising ends. No change in Pestarena stopes.

WEST CANADA.—F. Williams, May 4: Huron Copper Bay: The lode at Stephens's winze, sinking below the 35, west of Palmer's shaft, has not changed since last report, and still yields from 2 to 2½ tons of ore per fathom. The stope in bottom of the 20, east of this winze, yields 3 tons of ore per fm. The stope below the 35, west of Palmer's shaft, is worth 2½ tons of ore per fm.: this stope is now 12 fms. above the 50, and we think that the lode will shortly commence to improve as we descend. In the stope in the bottom of the 20, west of Powell's winze, we have taken away all the paying ground above the 35 to the west of this winze, and have put the men to stope a piece of ground standing to the east; it is worth 2 tons of ore per fathom. The stope over the 35, east of Bray's engine-shaft, yields fully 3½ tons of ore per fathom. The stope below the 35, east of shaft, and west of Bartie's winze, yields about 2½ tons of ore per fathom. The stope over the 35, east of this shaft, and west of Carmichael's winze, produces 2 tons of ore per fathom. The lode in the 50, west of Palmer's, looks well, and yields fully 3½ tons per fathom, with every appearance of its lasting some time. We have just commenced to stope west of this shaft, below the 50; the level was driven on the north part of the lode at this point, which is not very rich, but no doubt in opening up the south part it will prove much more productive. The lode in the 60, west of Palmer's, is still getting wider and more productive as we proceed; it yields fully 2 tons of ore per fathom. The lode in the 60, east of Bray's shaft, is again looking a little more promising. The lode in Bartie's yields 2 tons per fathom.—Wellington Mine: The stopes in the east and west of Rowe's shaft are not changed, and still yield on an average 2½ tons of ore per fm. Everything connected with the dressing department is going on satisfactorily. I beg to inform you that we are making good progress in raising building stones for the erection of the new works. We are also getting on as fast as possible with the necessary preparations at the brick-yard, and hope to commence to mould bricks in the course of a week. It will take us some weeks to get up the foundations, but we shall use every effort to get through with it as quickly as possible. We are short of hands at present, but we expect a number of men here by the first steamer, which will enable us to proceed with greater dispatch.

[For remainder of Foreign Mines see to-day's Journal.]

PURIFYING GAS.—The invention of Mr. E. PELOUZE, Paris, consists, first, in the employment of sawdust or other divided porous substance, organic or mineral, in conjunction with the sulphuric acid which has been previously diluted with water, together with such substances as are now generally employed for effecting the purification of gas, such, for example, as the oxides of iron, either before or after they have undergone the process of revivification.

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